MOTOROLA

Portable Remote Controls

MOTOROLA INC. COMMUNICATIONS DIVISION • **INSTRUCTION MANUAL**

Seminar Evaluation

Seminar Title____

City____________________________ **Date**____________________

Please indicate your rating of the following items:

	Excellent	Good	Fair	Poor
Presentation	( )	( )	( )	( )
Program Content	( )	( )	( )	( )

Which section of this program was most helpful?

____

____

Which section of this program was least helpful?

____

____

What have you learned from this seminar — specifically?

____

____

Would you recommend this seminar program to others?

Yes ( ) No ( )

What additional seminar subjects would be of interest to you?

____

____

____

PLEASE PRINT YOUR NAME ABOVE TITLE

____

COMPANY NAME

____

STREET ADDRESS

____

CITY, STATE & ZIP

____

(Use reverse for additional comments)

Regency Land Mobile Inc.
A Subsidiary of Regency Electronics Inc

4505 W. Hacienda Avenue
Las Vegas, NV 89118
1-800-634-6730/6593
in Nevada: 1-702-871-5181
Telex: 684-522
Int. Telex: 684-540

September 24, 1984

TO: ALL REGENCY LAND MOBILE DEALERS AND FIELD SALES OPERATIONS

Effective: October 1, 1984

Regency Land Mobile can now be contacted through Compuserve Computer Network.

If you are a subscriber to Compuserve's 'Consumer Information Service' (C.I.S.) or their 'Executive Information Service' (EIS), you can now use electronic mail (E-mail) to send and receive messages with Regency Land Mobile via your computer.

For those who are not familiar with Compuserve's nationwide computer network, you can get info from most personal computer stores or call Compuserve directly at 800-848-8990.

Regency's user number is 70370,700. (Keep this number for future reference).

Our 'mail box' will be checked first thing each morning and at approximately 1:30 pm, each workday (Pacific Time Zone).

Please put the name of the person or department in the 'subject' heading of your E-mail.

We will respond as soon as possible (according to the nature of your request), and expect that to be within 4 hours of us receiving your E-mail.

We feel that this is another step in speeding up communications with you. It will allow you to leave written messages for us, even if the offices are closed at the time. You can also retrieve our responses at your convenience.

We're looking forward to your use of this new Regency Land Mobile Service.

10-CHANNEL PROGRAMMING REFERENCE CARD

```
                            ┌──── Programming Data ────┐
Programming Data Format:  AAAAAA  B C  DD  ZZZZZZ    Enter    Chan No.
                            ①     ② ③  ④     ⑤         ⑥         ⑦
```

Programming Steps

1. Receiver Frequency (six digits)
   Note: For RH250UK if frequency is 7 digits subtract
   2.5 KHz and enter the resulting 6-digit frequency

2. Simplex/half Duplex Code (one digit)

   Simplex: B=0 half Duplex: B=8

3. CTCSS/Transmitter Operation Code (one digit)

   C=0 for normal RX/TX operation (CTCSS - Decode/Encode)
   C=2 for normal RX/TX operation (CTCSS - Encode only)
   C=4 for transmitter disabled (CTCSS - Decode only)

4. CTCSS Tone Code (two digits)

   DD = See table at right

5. Transmitter Frequency (six digits)

   See note on 1. Only to be entered for half/Duplex operation.

6. Press ENTER

7. Press the channel number the data is to be entered in.

Frequency	Code
no tone	00
67.00 Hz	01
71.90	02
74.4	03
77.0	04
79.7	05
82.5	06
85.4	07
88.5	08
91.5	09
94.8	10
97.4	11
100.0	12
103.5	13
107.2	14
110.9	15
114.8	16
118.8	17
123.0	18
127.3	19
131.8	20
136.5	21
141.3	22
146.2	23
151.4	24
156.7	25
162.2	26
167.9	27
173.8	28
179.9	29
186.2	30
192.8	31
203.5	32
210.7	33
218.1	34
225.7	35
233.6	36
241.8	37

16-CHANNEL PROGRAMMING REFERENCE CARD

	Channel Programming Code						Enter	Chan No.
Channel Programming Data Format:	AAAAAA	B	C	DD	YY	ZZZZZZ	Enter	Chan No.
	①	②	③	④	⑤	⑥	⑦	⑧

Channel Programming Steps

1. Receiver Frequency (six digits)

   Note: For RH256UK if the frequency is seven digits subtract 2.5 KHz and enter the results

2. Simplex/half-Duplex Code (one digit)

   Simplex: B=0 Half-Duplex: B=8

3. Transmitter Operation Code (one digit)

   Normal RX/TX operation: C=0 Disable Transmitter: C=4

4. Receiver CTCSS Tone Code (two digits)

   DD = See table at right

5. Transmitter CTCSS Tone Code (two digits)

   YY = See table at right. Does not need to be entered if Simplex channel and tone the same as 4. Must be specified if half-Duplex is programmed.

6. Transmitter Frequency (six digits)

   See note in 1. Does not need to be entered if Simplex channel.

7. Press the ENTER button on the keyboard

8. Press the channel number the data is to be entered into.

Frequency	Code
no tone	00
67.00 Hz	01
71.90	02
74.4	03
77.0	04
79.7	05
82.5	06
85.4	07
88.5	08
91.5	09
94.8	10
97.4	11
100.0	12
103.5	13
107.2	14
110.9	15
114.8	16
118.8	17
123.0	18
127.3	19
131.8	20
136.5	21
141.3	22
146.2	23
151.4	24
156.7	25
162.2	26
167.9	27
173.8	28
179.9	29
186.2	30
192.8	31
203.5	32
210.7	33
218.1	34
225.7	35
233.6	36
241.8	37

				Enter	Scan
Radio Configuration Data Format:	T	W	X	Enter	Scan
	①	②	③	④	⑤

Radio Configuration Programming Steps

1. Scan Delay Code

Delay	T for A,B,C	T for UK
.68 sec	0	1
1.3 sec	2	3
2.0 sec	4	5

2. T.O.T. Code

	W
No T.O.T.	0
30 sec	1
60 sec	2
120 sec	4

3. X = 0

4. Press ENTER

5. Press SCAN

   Channel display will display a "u"

PRODUCT NEWS

MA-337 - is a 2805 Decoder with a 600 Hz alert tone, horn igniter circuit, and scanner. This unit will replace the MA-194 in the XLH-257. The MA-337 has the same suggested retail price of $160.00 and the dealer cost of $120.00.

MA-338 - is a 2805 Decoder which will replace the MA-194 in the Micro-Com Portables. This unit's suggested retail price is $125.00 and the dealer price is $100.00. This unit will be available in September.

RAP-200 - is a half duplex automatic interconnect used with our repeaters. This interconnect's suggested retail price is $465.00 and the dealer price is $349.00. This unit will be available in September.

SAI-800 - is a Simplex Automatic Interconnect used with our cabinet type base stations ONLY. The suggested retail price is $586.00 and the dealer cost is $440.00. This unit will be available in September.

MA-182 - is now a LEATHER case again. The price will remain the same.

MA-182T - is a leather case for the Micro-Com Portables with the T.T.P. option. The suggested retail price is $34.00 and the dealer price is $25.50.

MA-312 - is an all new Tone Remote -- must be used with the MA-313. The suggested retail price is $500.00 and the dealer cost is $300.00. This unit will be available in November.

MA-313 - is a Tone Remote Termination Panel for the MA-312. This unit can only be used with the MCB line of Base Stations or, if used with the MA-326, may also be used with the MCCU-R45-100 Repeaters or MCCH-B50. The suggested retail price is $160.00 and the dealer price is $96.00.

BPS-20 L/H Regency has about another month's supply of the Base Power Supplies available. When the current supply is depleted, the following units will no longer be available: The BPS/BAL/301, BPS/BAL/304, and the BPS/BAH/24.

MCU-11B - We have fifty (50) units available and when that supply is depleted, this unit will be deleted from the Regency Product Line.

We still have a few of the following radios available and we will sell them on a first come - first served basis: (9) BTH-201A, (15) BTH-202A, (5) BTH-204A, (18) EMG-6, (17) MCV-21H, (37) MCV-22, and (2) MCV-24H.

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https://archive.org/details/motorolaportable00unse

PLL TROUBLESHOOTING PROCEDURE

SPECIAL NOTES:

- Following procedure is only valid for V.C.O. out of lock (high or low) and will not swing.
- Procedure not valid for off-frequency or VCO's with partial swing capabilities.
- However portions of this procedure may be applied to troubleshooting where other conditions exist.

ALWAYS

VERIFY UNIT IS PROGRAMMED PROPERLY!

PROCEDURE:

Remove loop filter output wire from VCO board.

A. Supply a 5VDC source to the point that the loop filter output line was removed.

Calculate fundamental frequency of VCO and verify output frequency of VCO for proper frequency and frequency swing capabilities.

Fund. VHF=$\frac{\text{Freq.}-10.7}{2}$ Fund. UHF=$\frac{\text{Freq.}-21.4}{2}$

B. If frequency OK; VCO board OK; proceed to C. If frequency incorrect or won't swing; VCO board has a problem.

C. Verify phase detector output of synthesizer. Will toggle by tuning VCO coil (0 to 5VDC):

If detector toggles OK; then synthesizer and data from processor are assumed to be OK; proceed to step F.

D. If phase detector does not toggle: Check data from processor with signature analyzer.

If data from processor incorrect; suspect processor, earom, or earom buffer.

E. If data is correct; verify pre-scaler output frequency is close to: $\frac{\text{VCO Frequency}}{\text{15 or 16}}$

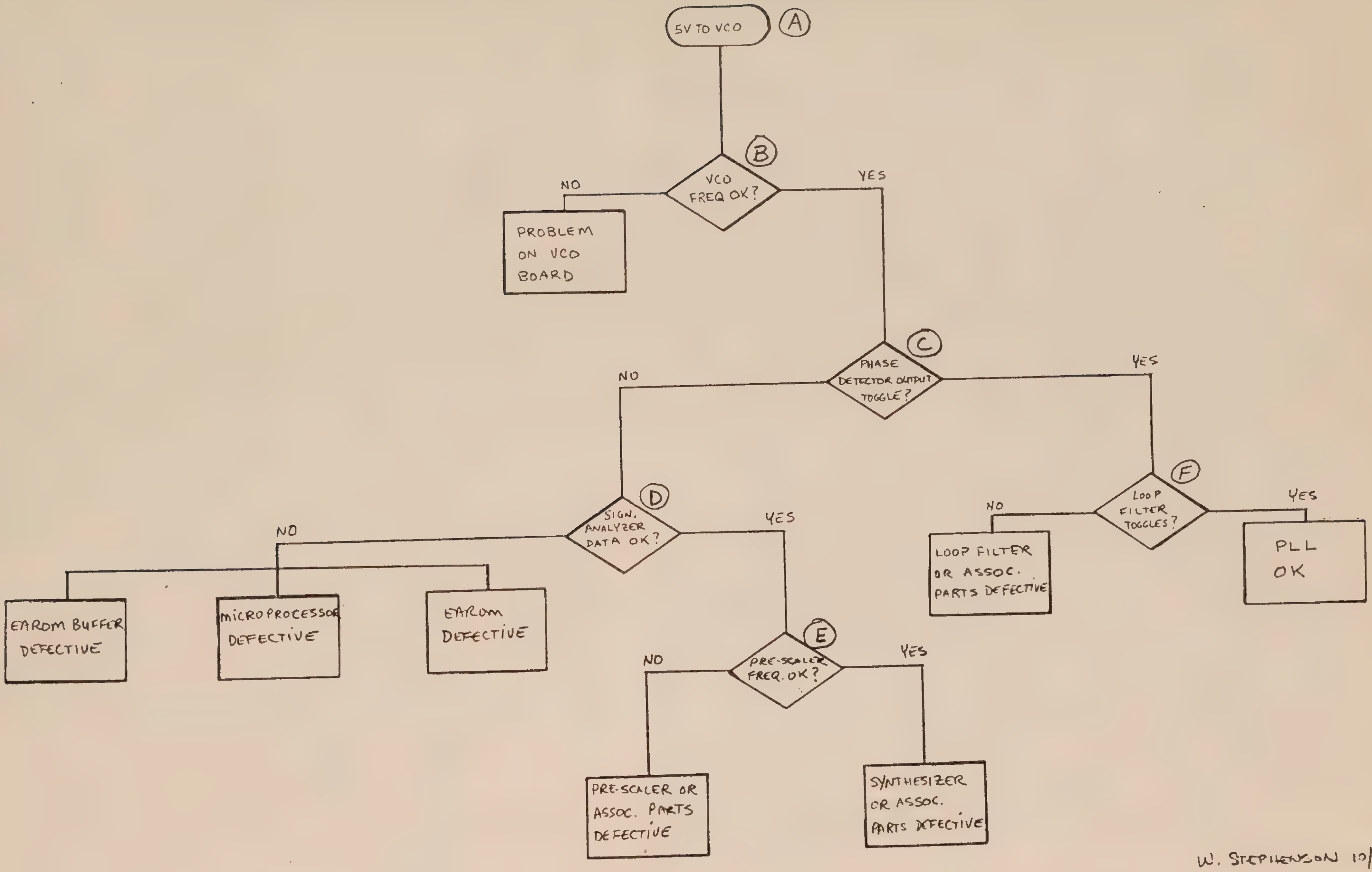
If pre-scaler frequency is incorrect: problem in pre-scaler or associated parts.

If pre-scaler frequency is correct and data from processor (via signature analyzer) is correct; then problem in synthesizer or associated parts.

F. Verify loop filter output toggles (0-9.5VDC) when tuning VCO coil. If output does not toggle; problem is in loop filter or associated parts.

If output of loop filter does toggle and all previous tests are valid, then P.L.L. should function.

Regency Products Group
Customer Service Department
Wayne Stephenson


5V TO VCO
A
B
VCO FREQ OK?
NO
YES
PROBLEM ON VCO BOARD
C
PHASE DETECTOR OUTPUT TOGGLE?
NO
YES
D
SIGN. ANALYZER DATA OK?
NO
YES
EAROM BUFFER DEFECTIVE
MICROPROCESSOR DEFECTIVE
EAROM DEFECTIVE
E
PRE-SCALER FREQ. OK?
NO
YES
PRE-SCALER OR ASSOC. PARTS DEFECTIVE
SYNTHESIZER OR ASSOC. PARTS DEFECTIVE
F
LOOP FILTER TOGGLES?
NO
YES
LOOP FILTER OR ASSOC. PARTS DEFECTIVE
PLL OK

W. STEPHENSON 10/84

SD 62

Page Ex 301

2064 3M wrist strap

3210 Table mate

Series 2900 Non Corrosive foam

Wake up

Power up FREQ	OLD XLH252	F1= / F2	150.000 T&R		136.5 N
	NEW XLH252		154.400 R	157.500 T	151.4N
Midway switch			155.5 R	156.1 T	No Tone
OLD	XLH152	F1	475.575 T&R		67N
No midway		F2	473.975 T&R		67N
NEW		F1&F2	460.5 R 465.5 T		151.4N
Midway			462.5 R	460.1 T	

Micro P 3870 Mostek, Fairchild, Motorola

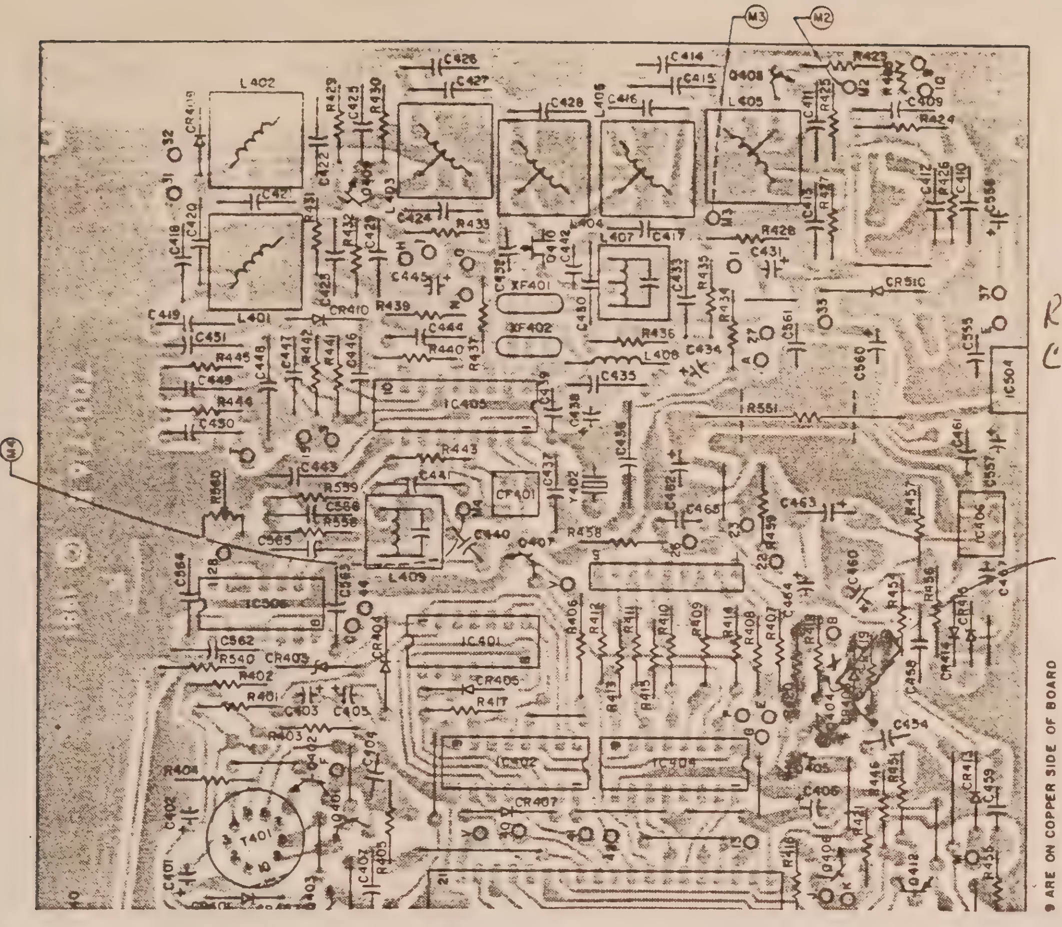
Be shure To get right Dash #

7 Strobe - clock 40 5VDC

32 - Serial data out 38 ETCSS in to chip squarewave

Pin 40 is 2.3 to 2.5VDC Bad syn. chip

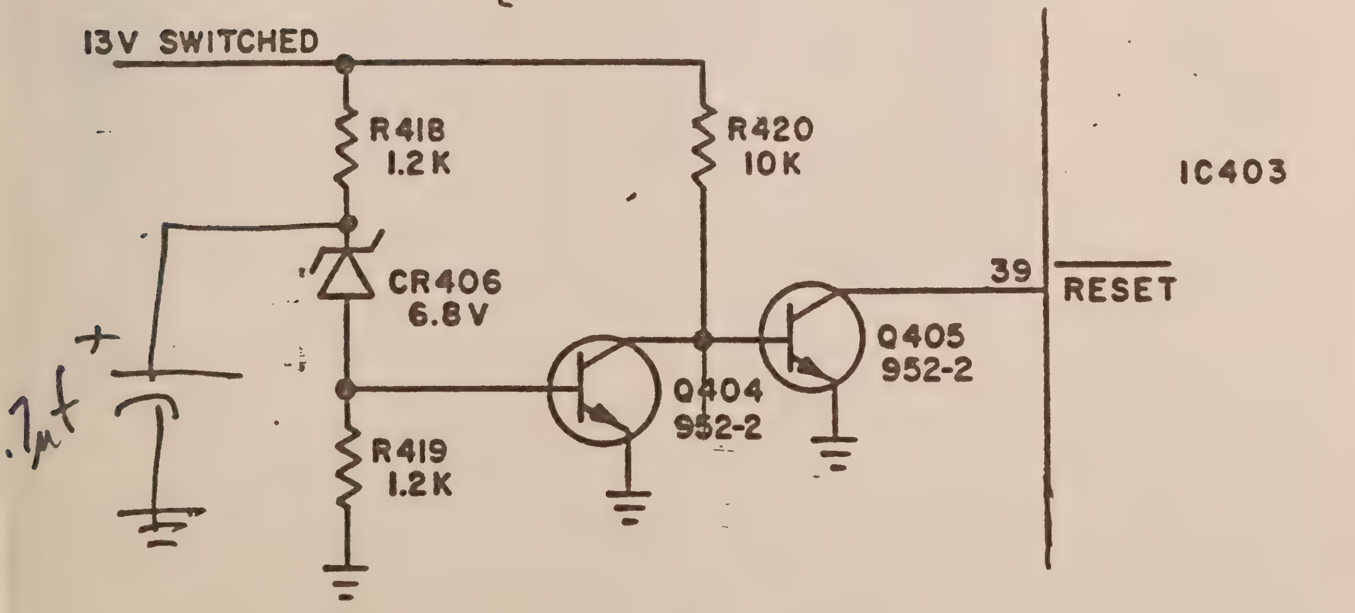
Ted Craven Regency
PO Box 621
Plano Tx 05074


M3
M2
M4
L402
L401
L404
L405
L406
L407
L408
L409
IC403
IC401
IC402
IC404
IC504
IC406
IC506
CF401
XF401
XF402
Y402
T401
Q403
Q404
Q405
Q407
R418
R419
R420
CR406
● ARE ON COPPER SIDE OF BOARD

Remove C470

4.7uF

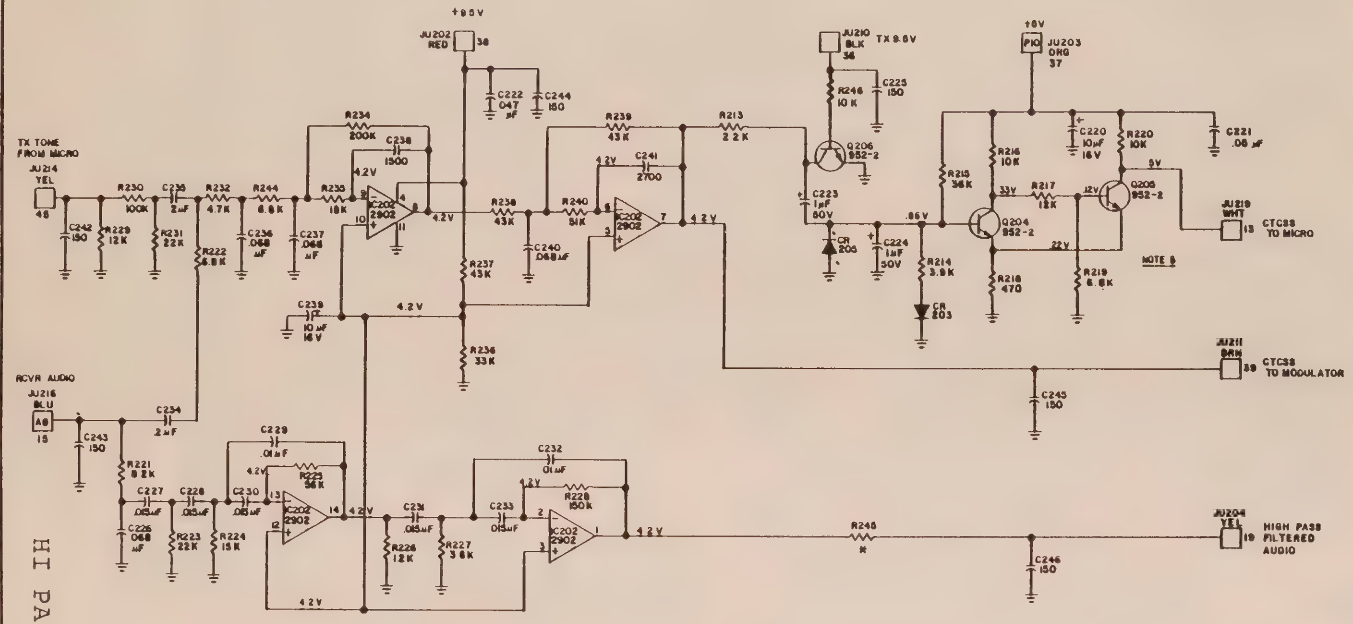
{RH 250 Reset Circuit}


13V SWITCHED
R418
1.2K
R420
10K
CR406
6.8V
.7uf
+
R419
1.2K
Q404
952-2
Q405
952-2
39
RESET
IC403

ALL 16 Ch RADIO'S
ALL 10 Ch RADIO'S After
7-10-85

MAIN BOARD, REV. B
PARTS OVERLAY

```
        GEOSTATIONARY SATELLITE LOCATOR

                  PROGRAM 3.0

                       BY:
                         David Frey
                         619 Avignon Dr.
                         Melbourne
                         Florida   32935

            EARTH STATION LOCATION:  SAN FRANCISCO - OAKLAND, CA
            EARTH STATION LATITUDE:  37.7775 DEGREES NORTH
            EARTH STATION LONGITUDE: 122.411 DEGREES WEST

            DECLINATION ERROR:        6.01 DEGREES

  SATELLITE        SATELLITE        ANTENNA          ANTENNA         POLAR
    NAME           LONGITUDE        AZIMUTH         ELEVATION        ANGLE
  ---------------------------------------------------------------------------
J-S ADJUST
  Satcom F2R        72     W         116.87           22.19          -56.11
  Galaxy 2          74     W         118.53           23.68          -53.96
  Westar 2          79     W         122.93           27.32          -48.55
  Satcom F4         83     W         126.7            30.12          -44.19
  Telstar 302       87     W         130.75           32.8           -39.8
  Westar 3          91     W         135.09           35.33          -35.38
  Galaxy 3          93.5   W         137.96           36.82          -32.61
  Telstar 301       96     W         140.97           38.24          -29.82
  Westar 4          99     W         144.75           39.82          -26.47
  Anik D            104.5  W         152.18           42.35          -20.29
ue Spacenet 1        120    W         176.06           46.14          -2.74
uth Westar 5         122.5  W         180.27           46.21            .19
  Comstar D4        127    W         187.47           45.95           5.22
  Satcom F3R        131    W         193.85           45.29           9.75
  Galaxy 1          134    W         198.51           44.55          13.15
- Satcom F1R        139    W         205.93           42.88          18.79
  Aurora F5         143    W         211.52           41.19          23.3
```



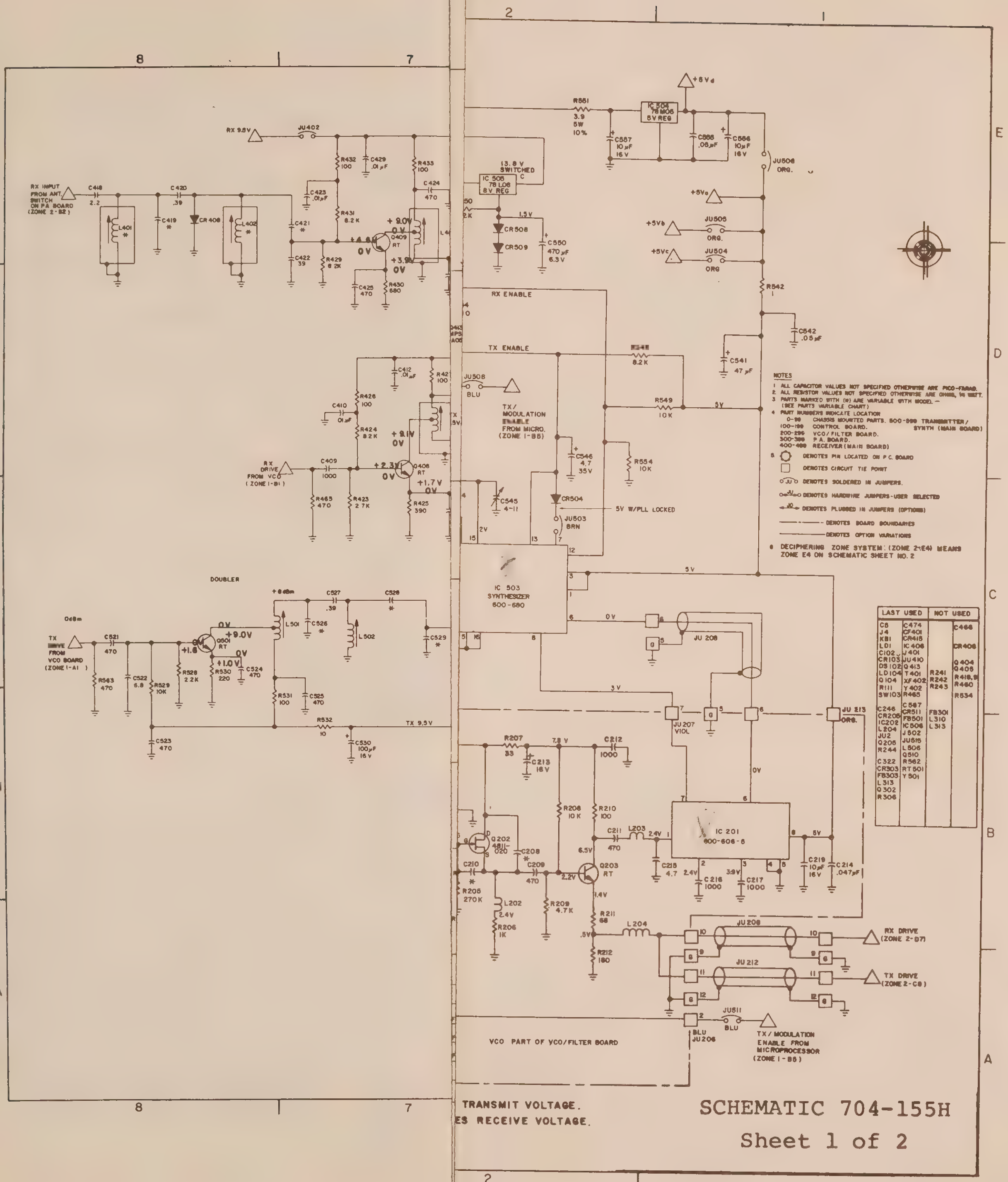
TX TONE FROM MICRO
JU214 YEL 48
C242 150
R229 12K
R230 100K
C235 2µF
R231 22K
R232 4.7K
R222 6.8K
R244 6.8K
C236 .068 µF
C237 .068 µF
R235 18K
R234 200K
C238 1500
IC202 2902
4.2V
+9.5V
JU202 RED 38
C222 .047 µF
C244 150
R238 43K
R237 43K
R236 33K
C239 10µF 16V
C240 .068µF
R240 51K
R239 43K
C241 2700
4.2V
R213 22K
JU210 BLK 36
TX 9.6V
R246 10K
C225 150
Q206 952-2
C223 1µF 50V
CR 205
.86V
C224 1µF 50V
R214 3.9K
CR 203
R215 36K
R216 10K
33V
Q204 952-2
R218 470
R217 12K
12V
22V
Q205 952-2
R219 6.8K
+8V
P10 JU203 ORG 37
C220 10µF 16V
R220 10K
9V
C221 .05 µF
JU219 WHT 13
CTCSS TO MICRO
NOTE 5
JU211 BRN 39
CTCSS TO MODULATOR
C245 150
RCVR AUDIO
JU216 BLU A8 15
C243 150
C234 .2µF
R221 8.2K
C227 .015µF
C226 .068 µF
C228 .015µF
R223 22K
C230 .015µF
R224 15K
C229 .01µF
R225 56K
C231 .015µF
R226 12K
R227 3.6K
C233 .015µF
C232 .01µF
R228 150K
R245 *
C246 150
JU204 YEL 19
HIGH PASS FILTERED AUDIO

NOTES
1. ALL CAPACITOR VALUES NOT SPECIFIED OTHERWISE ARE PICO-FARAD
2. ALL RESISTOR VALUES NOT SPECIFIED OTHERWISE ARE OHMS, ¼ WATT
3. ALL COMPONENTS ARE LOCATED ON VCO BOARD
4. THIS SCHEMATIC IN CONJUNCTION WITH RH 250 MAIN BOARD SCHEMATIC 704-168, SHEET 2.
5. VOLTAGES ON Q204 & Q205 ARE WITH AN UNMODULATED RF CARRIER.

* MODEL SENSITIVE PARTS

MODEL	R245	
RH250/256 A 132-150 MHz	4.7K	
RH250/256 B 150-162 MHz	4.7K	
RH250/256 C 162-174 MHz	4.7K	
RH250/256 UK 162-174 MHz	1.0K	

SCHEMATIC
HI PASS/LOW PASS FILTERS


RX 9.5V
JU402
RX INPUT FROM ANT. SWITCH ON P.A BOARD (ZONE 2-B2)
C418 2.2
C420 .39
L401
C419 *
CR406
L402 *
C421 *
C422 39
C423 .01µF
R432 100
C429 .01µF
R431 8.2K
R429 8.2K
Q409 RT
+4.8V
+9.0V
0V
+3.9V
C425 470
R430 680
R433 100
C424 470
13.8 V SWITCHED
IC 505 78 L06 8V REG
CR508
CR509
1.5V
C550 470µF 6.3V
R551 3.9 5W 10%
IC 504 78M05 5V REG
+8Vd
C557 10µF 16V
C558 .05µF
C556 10µF 16V
JU506 ORG.
+5Va
+5Vb
JU505 ORG.
+5Vc
JU504 ORG
R542 1
C542 .05µF
C541 47µF
RX ENABLE
TX ENABLE
8.2K
R549 10K
5V
JU508 BLU
TX/MODULATION ENABLE FROM MICRO. (ZONE 1-B5)
C546 4.7 35V
R554 10K
C545 4-11
CR504
5V W/PLL LOCKED
JU503 BRN
C412 .01µF
R426 100
C410 .01µF
R424 8.2K
+9.1V
0V
RX DRIVE FROM VCO (ZONE 1-B1)
C409 1000
+2.3V
Q408 RT
+1.7V
R465 470
R423 2.7K
R425 390
IC 503 SYNTHESIZER 600-680
DOUBLER
0dBm
+6dBm
TX DRIVE FROM VCO BOARD (ZONE 1-A1)
C521 470
Q501 RT
+1.6
+9.0V
+1.0V
C524 470
R563 470
C522 6.8
R529 10K
R528 2.2K
R530 220
C527 .39
C526 *
C528 *
L501
C525 *
L502
C529 *
R531 100
C525 470
R532 10
TX 9.5V
C530 100µF 16V
C523 470
0V
3V
JU 208
JU 207 VIOL
JU 213 ORG.
R207 33
7.8 V
C213 16V
C212 1000
R208 10K
R210 100
C211 470
L203
2.4V
IC 201 600-606-6
Q202 4811-020
C208 *
C210 *
C209 470
R205 270K
L202
R206 1K
R209 4.7K
6.5V
2.2V
Q203 RT
1.4V
C218 4.7
C216 1000
C217 1000
C219 10µF 16V
C214 .047µF
R211 68
L204
R212 180
JU 209
JU 212
RX DRIVE (ZONE 2-D7)
TX DRIVE (ZONE 2-C8)
JU511 BLU
BLU JU206
TX/MODULATION ENABLE FROM MICROPROCESSOR (ZONE 1-B5)
VCO PART OF VCO/FILTER BOARD
8
7
2
1
E
D
C
B
A

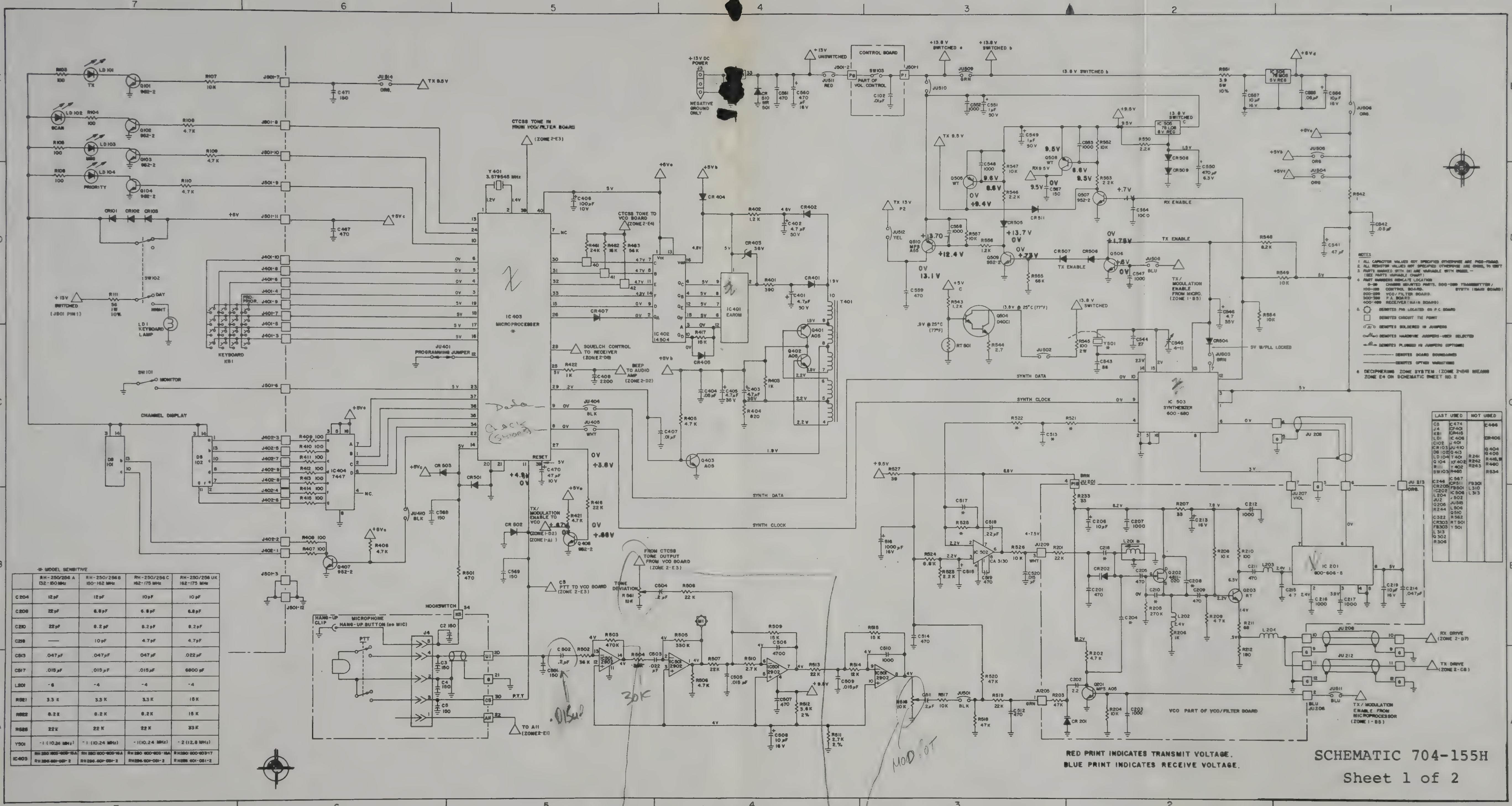
NOTES

1 ALL CAPACITOR VALUES NOT SPECIFIED OTHERWISE ARE PICO-FARAD.
2 ALL RESISTOR VALUES NOT SPECIFIED OTHERWISE ARE OHMS, ¼ WATT.
3 PARTS MARKED WITH (*) ARE VARIABLE WITH MODEL — (SEE PARTS VARIABLE CHART)
4 PART NUMBERS INDICATE LOCATION
  0-99 CHASSIS MOUNTED PARTS. 500-599 TRANSMITTER/SYNTH (MAIN BOARD)
  100-199 CONTROL BOARD.
  200-299 VCO/FILTER BOARD.
  300-399 P.A. BOARD.
  400-499 RECEIVER (MAIN BOARD)
5 ○ DENOTES PIN LOCATED ON P.C. BOARD
  □ DENOTES CIRCUIT TIE POINT
  JU DENOTES SOLDERED IN JUMPERS.
  JU DENOTES HARDWIRE JUMPERS-USER SELECTED
  JO DENOTES PLUGGED IN JUMPERS (OPTIONS)
  DENOTES BOARD BOUNDARIES
  DENOTES OPTION VARIATIONS
6 DECIPHERING ZONE SYSTEM: (ZONE 2-E4) MEANS ZONE E4 ON SCHEMATIC SHEET NO. 2

LAST USED		NOT USED	
C8 J4 KB1 LD1 C102 CR103 DS102 LD104 Q104 R111 SW103	C474 CF401 CR418 IC406 J401 JU410 Q413 T401 XF402 Y402 R465	R241 R242 R243	C466 CR406 Q404 Q405 R418,9 R460 R534
C246 CR206 IC202 L204 JU2 Q206 R244	C567 CR511 FB501 IC506 J602 JU515 L506 Q510 R562 RT501 Y501	FB301 L310 L313	
C322 CR303 FB303 L313 Q302 R306			

TRANSMIT VOLTAGE.
ES RECEIVE VOLTAGE.

SCHEMATIC 704-155H
Sheet 1 of 2


LD 101
TX
LD 102
SCAN
LD 103
LD 104
PRIORITY
Q101
Q102
Q103
Q104
CR101
CR102
CR103
SW102
DAY
NIGHT
+13V SWITCHED (J501 PIN 1)
LD1 KEYBOARD LAMP
KEYBOARD KB1
SW101 MONITOR
CHANNEL DISPLAY
DS 101
DS 102
IC404 7447
Q407
HOOKSWITCH
HANG-UP CLIP
MICROPHONE HANG-UP BUTTON (on MIC)
PTT
J4
TO A11 (ZONE 2-E1)
CTCSS TONE IN FROM VCO/FILTER BOARD (ZONE 2-E3)
Y401 3.579545 MHz
IC403 MICROPROCESSOR
JU401 PROGRAMMING JUMPER
SQUELCH CONTROL TO RECEIVER (ZONE 2-D8)
BEEP TO AUDIO AMP (ZONE 2-D2)
CTCSS TONE TO VCO BOARD (ZONE 2-E4)
RESET
TX/ MODULATION ENABLE TO VCO (ZONE 1-A1)
C5 PTT TO VCO BOARD (ZONE 2-E3)
Q406
IC402 14504
IC401 EAROM
Q401
Q402
Q403
T401
SYNTH DATA
SYNTH CLOCK
FROM CTCSS TONE OUTPUT FROM VCO BOARD (ZONE 2-E3)
TONE DEVIATION
IC501 2902
+13V DC POWER J3
NEGATIVE GROUND ONLY
+13V UNSWITCHED
CONTROL BOARD
SW103 PART OF VOL. CONTROL
+13.8V SWITCHED a
+13.8V SWITCHED b
13.8 V SWITCHED b
IC 504 78 M05 5V REG
IC 505 78 L08 8V REG
Q505
Q506
Q507
Q508
Q509
Q510
RX ENABLE
TX ENABLE
TX/ MODULATION ENABLE FROM MICRO. (ZONE 1-B5)
Q504
RT 501
Y501
5V W/PLL LOCKED
IC 503 SYNTHESIZER 600-680
IC 502 CA 3130
Q201
Q202
Q203
IC 201 600-606-5
L201
JU 208
JU 212
JU 213
RX DRIVE (ZONE 2-D7)
TX DRIVE (ZONE 2-C8)
TX/ MODULATION ENABLE FROM MICROPROCESSOR (ZONE 1-B5)
VCO PART OF VCO/FILTER BOARD

Data

Clock (Strobe)

.015u?

30K

MOD POT

120K to 1.2M

Hi Noise level

So Soft Voice

Hi while Voltage will [illegible]

- MODEL SENSITIVE

	RH-250/256 A 132-150 MHz	RH-250/256 B 150-162 MHz	RH-250/256 C 162-175 MHz	RH-250/256 UK 162-175 MHz
C204	12 pF	12 pF	10 pF	10 pF
C208	22 pF	6.8 pF	6.8 pF	6.8 pF
C210	22 pF	8.2 pF	8.2 pF	8.2 pF
C218	—	10 pF	4.7 pF	4.7 pF
C513	.047 µF	.047 µF	.047 µF	.022 µF
C517	.015 µF	.015 µF	.015 µF	6800 pF
L201	-6	-4	-4	-4
R521	3.3 K	3.3 K	3.3 K	16 K
R522	8.2 K	8.2 K	8.2 K	15 K
R525	22 K	22 K	22 K	33 K
Y501	-1 (10.24 MHz)	-1 (10.24 MHz)	-1 (10.24 MHz)	-2 (12.8 MHz)
IC403	RH 250 600-603-15A RH 256 601-051-2	RH 250 600-603-16A RH 256 601-051-2	RH 250 600-603-16A RH 256 601-051-2	RH 250 600-603-17 RH 256 601-051-2

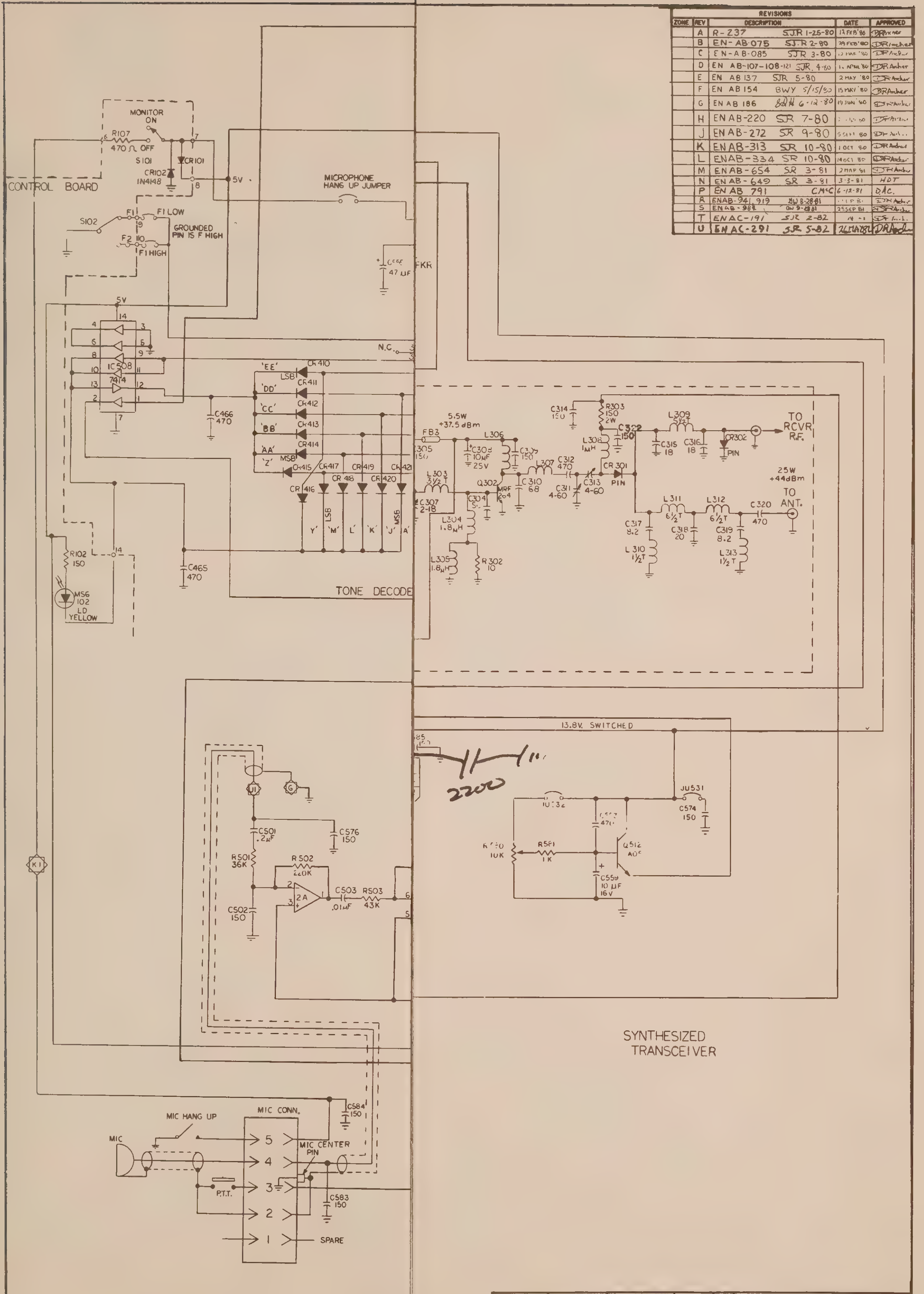
NOTES

1. ALL CAPACITOR VALUES NOT SPECIFIED OTHERWISE ARE PICO-FARAD.
2. ALL RESISTOR VALUES NOT SPECIFIED OTHERWISE ARE OHMS, ¼ WATT
3. PARTS MARKED WITH (*) ARE VARIABLE WITH MODEL — (SEE PARTS VARIABLE CHART)
4. PART NUMBERS INDICATE LOCATION
   - 0-99 CHASSIS MOUNTED PARTS.
   - 100-199 CONTROL BOARD.
   - 200-299 VCO/ FILTER BOARD.
   - 300-399 P.A. BOARD
   - 400-499 RECEIVER (MAIN BOARD)
   - 500-599 TRANSMITTER/ SYNTH (MAIN BOARD)
5. ○ DENOTES PIN LOCATED ON P.C. BOARD
   - ☐ DENOTES CIRCUIT TIE POINT
   - DENOTES SOLDERED IN JUMPERS
   - DENOTES HARDWIRE JUMPERS—USER SELECTED
   - DENOTES PLUGGED IN JUMPERS (OPTIONS)
   - DENOTES BOARD BOUNDARIES
   - DENOTES OPTION VARIATIONS
6. DECIPHERING ZONE SYSTEM. (ZONE 2-E4) MEANS ZONE E4 ON SCHEMATIC SHEET NO. 2

LAST USED		NOT USED	
C6 J4 KB1 LD1 C102 CR103 DS 102 LD 104 Q 104 R111 SW103	C474 CF401 CR416 IC 406 J 401 JU 410 Q 413 T 401 XF 402 Y 402 R465		C466 CR406 Q 404 Q 406 R 418 R 460 R534
C246 CR208 IC202 L 204 JU2 Q206 R244	C 567 CF511 FB501 IC 506 J 502 JU515 L 506 Q510 R 562 RT 501 Y 501	R241 R242 R243	
C322 CR303 FB303 L 313 Q 302 R306		FB301 L 310 L 313	

RED PRINT INDICATES TRANSMIT VOLTAGE.
BLUE PRINT INDICATES RECEIVE VOLTAGE.

SCHEMATIC 704-155H
Sheet 1 of 2


MONITOR
ON
R107
470 Ω OFF
S101
CR101
CR102
1N4148
CONTROL BOARD
5V
MICROPHONE
HANG UP JUMPER
S102
F1
F1 LOW
F2
GROUNDED
PIN IS F HIGH
F1 HIGH
C
47 µF
SPKR
5V
IC508
7414
N.C.
'EE'
LSB
CR410
'DD'
CR411
'CC'
CR412
'BB'
CR413
'AA'
CR414
'Z'
MSB
CR415
CR417
CR419
CR421
CR416
CR418
CR420
LSB
MSB
'Y'
'M'
'L'
'K'
'J'
'A'
C466
470
C465
470
TONE DECODE
R102
150
MS6
102
LD
YELLOW
K1
5.5W
+37.5 dBm
FB3
L305
150
C308
10 µF
25V
L306
C309
150
L307
C312
470
C314
150
R303
150
2W
L308
1 µH
C322
150
L309
5½T
C315
18
C316
18
CR302
PIN
TO
RCVR
R.F.
CR 301
PIN
C310
68
C311
4-60
C313
4-60
L303
3½T
Q302
MRF
264
C304
C307
2-18
L304
1.8 µH
L305
1.8 µH
R302
10
25W
+44 dBm
TO
ANT.
L311
6½T
L312
6½T
C320
470
C317
8.2
C318
20
C319
8.2
L310
1½T
L313
1½T
13.8V. SWITCHED
2200
JU531
C574
150
C
470
R560
10K
R561
1K
Q512
C559
10 µF
16V
U1
C501
.2 µF
C576
150
R501
36K
R502
220K
2A
C503
.01 µF
R503
43K
C502
150
6
5
SYNTHESIZED
TRANSCEIVER
MIC HANG UP
MIC
MIC CONN.
C584
150
MIC CENTER
PIN
P.T.T.
C583
150
5
4
3
2
1
SPARE

REVISIONS				
ZONE	REV	DESCRIPTION	DATE	APPROVED
	A	R-237 SJR 1-25-80	13 FEB '80	DRArcher
	B	EN-AB-075 SJR 2-80	29 FEB '80	DRArcher
	C	EN-AB-085 SJR 3-80	12 MAR '80	DRArcher
	D	EN AB-107-108-121 SJR. 4-80	1 APRIL '80	DRArcher
	E	EN AB 137 SJR 5-80	2 MAY '80	DRArcher
	F	EN AB 154 BWY 5/15/80	15 MAY '80	DRArcher
	G	EN AB 186 [illegible] 6-12-80	19 JUN '80	DRArcher
	H	EN AB-220 SR 7-80	[illegible] 80	DRArcher
	J	EN AB-272 SR 9-80	5 SEPT 80	DRArcher
	K	EN AB-313 SR 10-80	1 OCT 80	DRArcher
	L	ENAB-334 SR 10-80	14 OCT 80	DRArcher
	M	ENAB-654 SR 3-81	2 MAR 81	DRArcher
	N	EN AB-649 SR 3-81	3-3-81	HDT
	P	EN AB 791 CMcC	6-12-81	D.A.C.
	R	ENAB-941, 919 BWB-28-81	[illegible]	DRArcher
	S	ENAB-988 GW 9-28-81	25 SEP 81	DRArcher
	T	ENAC-191 SJR 2-82	[illegible]	DRArcher
	U	ENAC-291 SR 5-82	26 MAY 82	DRArcher

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES.
TOLERANCES ARE:
FRACT ± DEC .xx± .xxx± ANGLE ±
MATERIAL
FINISH
DO NOT SCALE DWG.

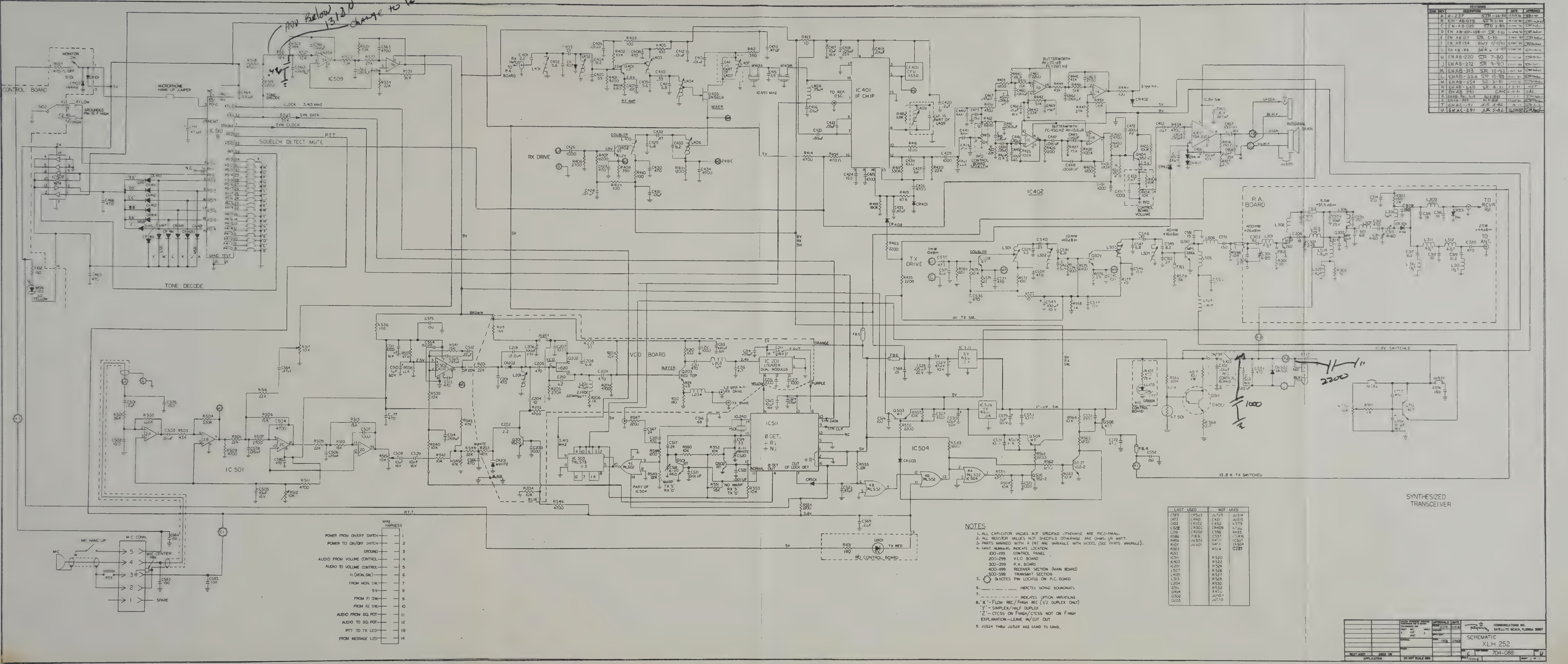
NEXT ASSY | USED ON
APPLICATION

APPROVALS | DATE
DRAWN SJR | 1-25-80
CHECKED
DFTG. SUPV
ENGR. DRA | 21 Feb '80

Regency COMMUNICATIONS INC.
SATELLITE BEACH, FLORIDA 32937

SCHEMATIC
XLH 252

SIZE E
PART NUMBER 704-088
REV. U
SCALE NONE
SHEET 1 OF 1


Adv Below 1313 Ω
Change to 12K
.44
CONTROL BOARD
MONITOR ON
OFF
F1 LOW
GROUNDED PIN 15 F HIGH
F2 HIGH
MICROPHONE HANG UP JUMPER
IC 510
IC509
TONE ENCODE
CLOCK 3.413 MHZ
SYN DATA
SYN CLOCK
PTT
SQUELCH DETECT MUTE
TONE DECODE
YELLOW
RX INPUT TO P.A. BOARD
R F AMP
MIXER
10.695 MHZ
DOUBLER
RX DRIVE
IC401 IF CHIP
TO REF. OSC.
CF401 CFU 455D
BUTTERWORTH
IC402
VOLUME
CONTROL BOARD
SQUELCH
INTERNAL SPKR
GREEN
BLACK
P.A. BOARD
TO RCVR
TO ANT.
TX DRIVE
VCO BOARD
BROWN
GREEN
BUFFER
LOUNTER DUAL MODULUS
IC 201
ORANGE
PURPLE
YELLOW
RX DRIVE
TX DRIVE
IC511
Ø DET.
IC 503 74LS73
IC 501
IC504
WARP TX'5' RX'0'
NO WARP RX'5' TX'0'
SYN DATA
SYN CLK
13.8V SWITCHED
13.8 V. TX SWITCHED
2200
1000
TX RED
CONTROL BOARD
MIC
MIC HANG UP
MIC CONN.
MIC CENTER PIN
PTT
SPARE
P.T.T.
WIRE HARNESS
POWER FROM ON/OFF SWITCH — 1
POWER TO ON/OFF SWITCH — 2
GROUND — 3
AUDIO FROM VOLUME CONTROL — 4
AUDIO TO VOLUME CONTROL — 5
K1 (MON. SW.) — 6
FROM MON. SW. — 7
5V — 8
FROM F1 SW. — 9
FROM F2 SW. — 10
AUDIO FROM SQ. POT — 11
AUDIO TO SQ. POT — 12
PTT TO TX LED — 13
FROM MESSAGE LED — 14
SYNTHESIZED TRANSCEIVER

REVISIONS				
ZONE	REV	DESCRIPTION	DATE	APPROVED
	A	R-237 SJR 1-25-80	13 FEB '80	DRAncher
	B	EN-AB 075 SJR 2-80	19 FEB '80	DRAncher
	C	EN-AB-085 SJR 3-80	13 MAR '80	DRAncher
	D	EN AB-107-108-121 SJR 4-80	15 APR '80	DRAncher
	E	EN AB 137 SJR 5-80	2 MAY '80	DRAncher
	F	EN AB-154 BWY 5/15/80	15 MAY '80	DRAncher
	G	EN AB 186 [illegible] 6 2 80	[illegible]	[illegible]
	H	EN AB-220 SR 7-80	[illegible] '80	DRAncher
	J	EN AB-272 SR 9-80	5 SEPT '80	[illegible]
	K	EN AB-313 SR 10-80	1 OCT '80	DRAncher
	L	EN AB-334 SR 10-80	14 OCT '80	DRAncher
	M	EN AB-654 SR 3-81	[illegible] MAR '81	DRAncher
	N	EN AB-649 SR 3-81	3 3-81	HOT
	P	EN AB 791 CMcC	6-12-81	DAC.
	R	ENAB-941 919 [illegible]	[illegible]	DRAncher
	S	ENAB-988 [illegible]	25 SEP 81	DRAncher
	T	ENAC-191 SJR 2-82	[illegible]	DRAncher
	U	ENAC-291 SR 5-82	26 MAY 82	DRAncher

NOTES

1. ALL CAPACITOR VALUES NOT SPECIFIED OTHERWISE ARE PICO-FARAD.
2. ALL RESISTOR VALUES NOT SPECIFIED OTHERWISE ARE OHMS, 1/4 WATT.
3. PARTS MARKED WITH A (*) ARE VARIABLE WITH MODEL (SEE PARTS VARIABLE).
4. PART NUMBERS INDICATE LOCATION.
   100-199 CONTROL PANEL
   200-299 VCO BOARD
   300-399 P.A. BOARD
   400-499 RECEIVER SECTION (MAIN BOARD)
   500-599 TRANSMIT SECTION
5. ◇ DENOTES PIN LOCATED ON P.C. BOARD
6. —— - —— - —— INDICTES BOARD BOUNDARIES
7. - - - - - - - - - - INDICATES OPTION VARIATIONS
8. 'X' - FLOW REC/FHIGH REC (1/2 DUPLEX ONLY)
   'Y' - SIMPLEX/HALF DUPLEX
   'Z' - CTCSS ON FHIGH/CTCSS NOT ON FHIGH
   EXPLANATION - LEAVE IN/CUT OUT
9. JU524 THRU JU528 ARE GRND TO GRND.

LAST USED		NOT USED	
C585	CR503	JU529	JU514
C473	CR421	C421	JU515
C103	CR102	C452	R579
C322	CR302	CR409	R[illegible]
C219	CR202	C556	R455
R586	FB6	C557	CR406
R456	JU532	R4[illegible]	IC507
R107	JU201	R4[illegible]	CR504
R303		R514	C321
R213			
IC511		R520	
IC403		R522	
IC201		R524	
L507		R526	
L409		R527	
L313		R528	
L204		R530	
Q516		R532	
Q404		R45[illegible]	
Q302		JU503	
Q203		JU510	

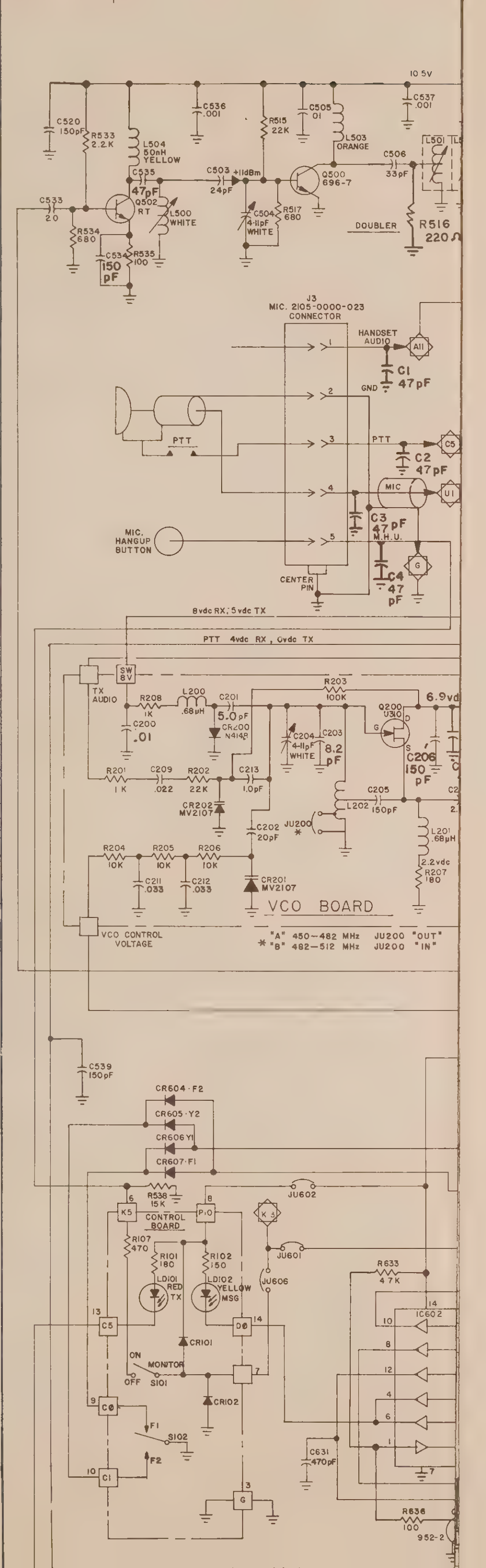
NEXT ASSY	USED ON	DO NOT SCALE DWG	APPROVALS SJR	DATE 1-25-80
APPLICATION			DRA	3 Feb '80

Regency COMMUNICATIONS INC.
SATELLITE BEACH, FLORIDA 32937

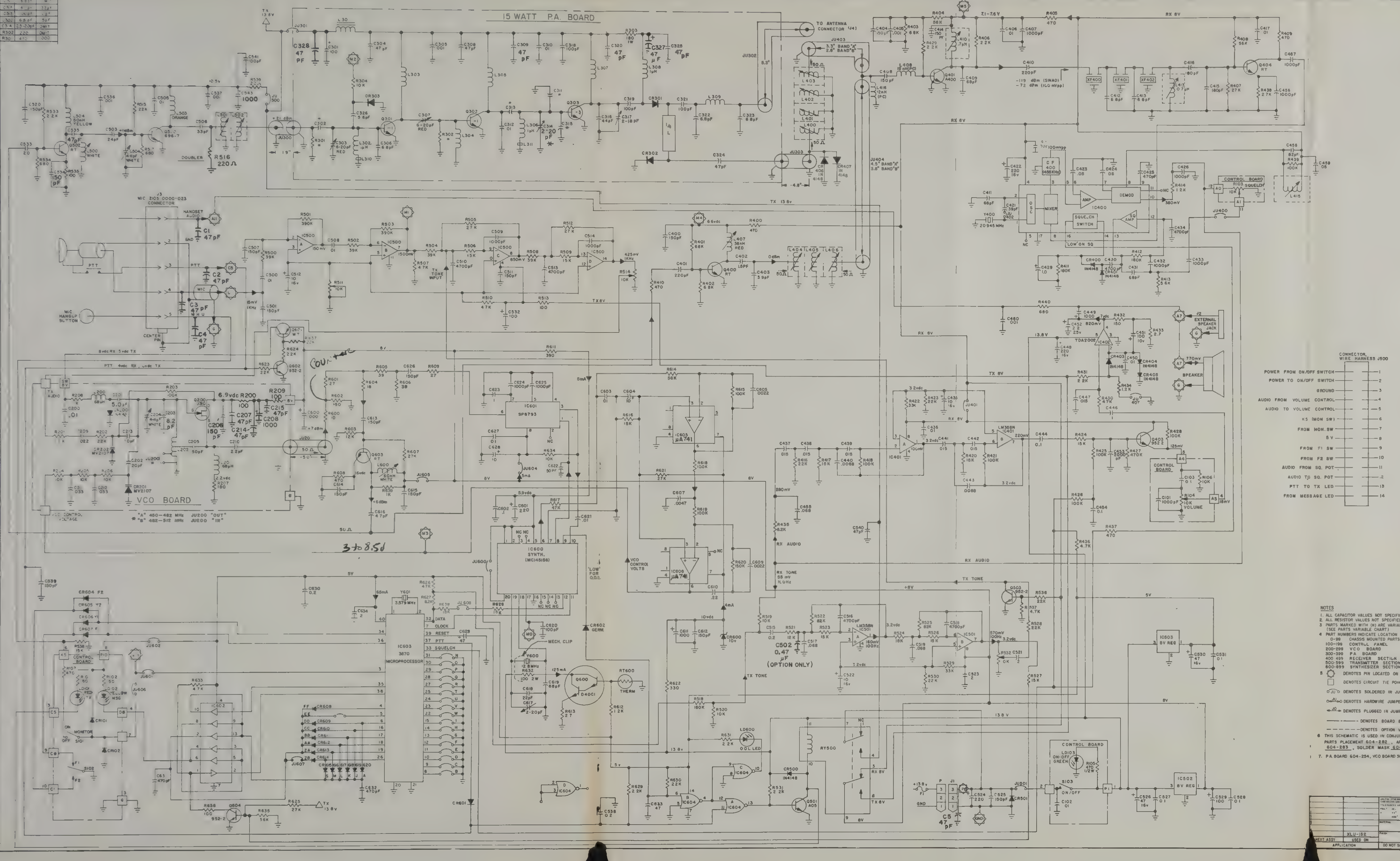
SCHEMATIC
XLH 252

E 704-088 U
SCALE NONE
SHEET 1 OF 1

	BAND A	BAND B
C311	6.8pF	OMIT
C315	40pF	33pF
C313	100pF	10pF
C302	6.8 pF	15pF
C314	2.5-20pF	OMIT
R302	220	OMIT
R301	470	1000


10.5V
C520 150pF
R533 2.2K
L504 50nH YELLOW
C536 .001
R515 22K
C505 .01
L503 ORANGE
C537 .001
C506 33pF
L501
C535 47pF
C503 24pF
+11dBm
Q500 696-7
C533 20
Q502 RT
L500 WHITE
C504 4-11pF WHITE
R517 680
DOUBLER
R516 220Ω
R534 680
C534 150 pF
R535 100
J3
MIC. 2105-0000-023
CONNECTOR
HANDSET AUDIO
A11
C1 47pF
GND
PTT
C5
C2 47pF
MIC
U1
C3 47pF
M.H.U.
G
C4 47 pF
MIC. HANGUP BUTTON
CENTER PIN
8vdc RX; 5vdc TX
PTT 4vdc RX, 0vdc TX
SW 8V
TX AUDIO
R208 1K
L200 .68µH
C201 5.0pF
CR200 N4148
C200 .01
R203 100K
Q200 U310
G D S
6.9vd
C204 4-11pF WHITE
C203 8.2 pF
C206 150 pF
R201 1K
C209 .022
R202 22K
C213 1.0pF
CR202 MV2107
C205 150pF
L202
JU200 *
C202 20pF
L201 .68µH
2.2vdc
R207 180
R204 10K
R205 10K
R206 10K
C211 .033
C212 .033
CR201 MV2107
VCO BOARD
VCO CONTROL VOLTAGE
"A" 450–482 MHz JU200 "OUT"
* "B" 482–512 MHz JU200 "IN"
C539 150pF
CR604·F2
CR605·Y2
CR606 Y1
CR607·F1
R538 15K
JU602
K5
P10
K3
CONTROL BOARD
R107 470
R101 180
R102 150
JU601
JU606
LD101 RED TX
LD102 YELLOW MSG
R633 47K
IC602
C5
D0
CR101
ON
MONITOR
OFF
S101
CR102
C0
F1
S102
F2
C1
G
C631 470pF
R636 100
952-2

*	BAND A	BAND B
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
[illegible]	6.8 pF	5pF
[illegible]	2.5-20pF	OMIT
R302	220	OMIT
R30[illegible]	[illegible]	[illegible]


15 WATT P.A BOARD
TO ANTENNA CONNECTOR (J4)
VCO BOARD
"A" 460-482 MHz JU200 "OUT"
"B" 482-512 MHz JU200 "IN"
DOUBLER
MIC JACK
PTT
MIC HANGUP BUTTON
CENTER PIN
HANDSET
CONTROL BOARD
SQUELCH SWITCH
LOW ON SQ
MIXER
AMP
DEMOD
IC400
IC401
IC600 SYNTH. (MC145158)
IC601 SP8793
IC603 3870 MICROPROCESSOR
IC605 µA741
IC606 µA741
VOLUME
EXTERNAL SPEAKER JACK
SPEAKER
MECH. CLIP
THERM
OOL LED
RY500
IC502 8V REG
IC503 5V REG
ON-OFF
MONITOR
(OPTION ONLY)
CONNECTOR, WIRE HARNESS J500
POWER FROM ON/OFF SWITCH 1
POWER TO ON/OFF SWITCH 2
GROUND 3
AUDIO FROM VOLUME CONTROL 4
AUDIO TO VOLUME CONTROL 5
KS (MON SW) 6
FROM MON. SW 7
5 V 8
FROM F1 SW 9
FROM F2 SW 10
AUDIO FROM SQ. POT 11
AUDIO TO SQ. POT 12
PTT TO TX LED 13
FROM MESSAGE LED 14
3 to 8.5 d

REVISIONS				
ZONE	REV	DESCRIPTION	DATE	APPROVED
	A	EN AB-640 DCD 12 12 80	[illegible]	[illegible]
	B	EN AB 661 GW 5-27-81	[illegible]	[illegible]
	C	EN AB-748 SJR [illegible]	[illegible]	[illegible]
	D	EN AB 866 RGR 8 [illegible] 8	[illegible]	[illegible]
	E	EN AB 949 GW 9 4 8	[illegible]	[illegible]
	F	[illegible]	[illegible]	[illegible]
	G	EN [illegible] SR [illegible]	[illegible]	[illegible]
	H	EN AC-113 RDR [illegible]	[illegible] 82	HDT
	J	EN AC 261 RDR 4·82	15 AP 82	SDRA
	K	EN AC 397 RDR 7·82	27 JUL 82	SDRA

LAST USED		NOT USED	
C103	C215		
C328	C460	C418	C420
C543	C634	C427	C428
R107	R209	C445	L411
R304	R440		[illegible]
R539	R639	R419	R415
IC402	IC503		
IC606	C5	Q402	CR100
Q200	Q303	L412	CR603
Q404	Q503	L414	
Q604		CR402	
CR102	CR202		
CR303	CR407		
CR501	CR620	C502	
L202	L311		
L416	L600	C542	
LD103	LD600	C606	
RT600		C608	
Y400	Y601	R610	
XF402			
CF400			
L504			
JU303	JU201	JU406	
JU407	JU501		
JU606	J4		
RY500	J500		

NOTES

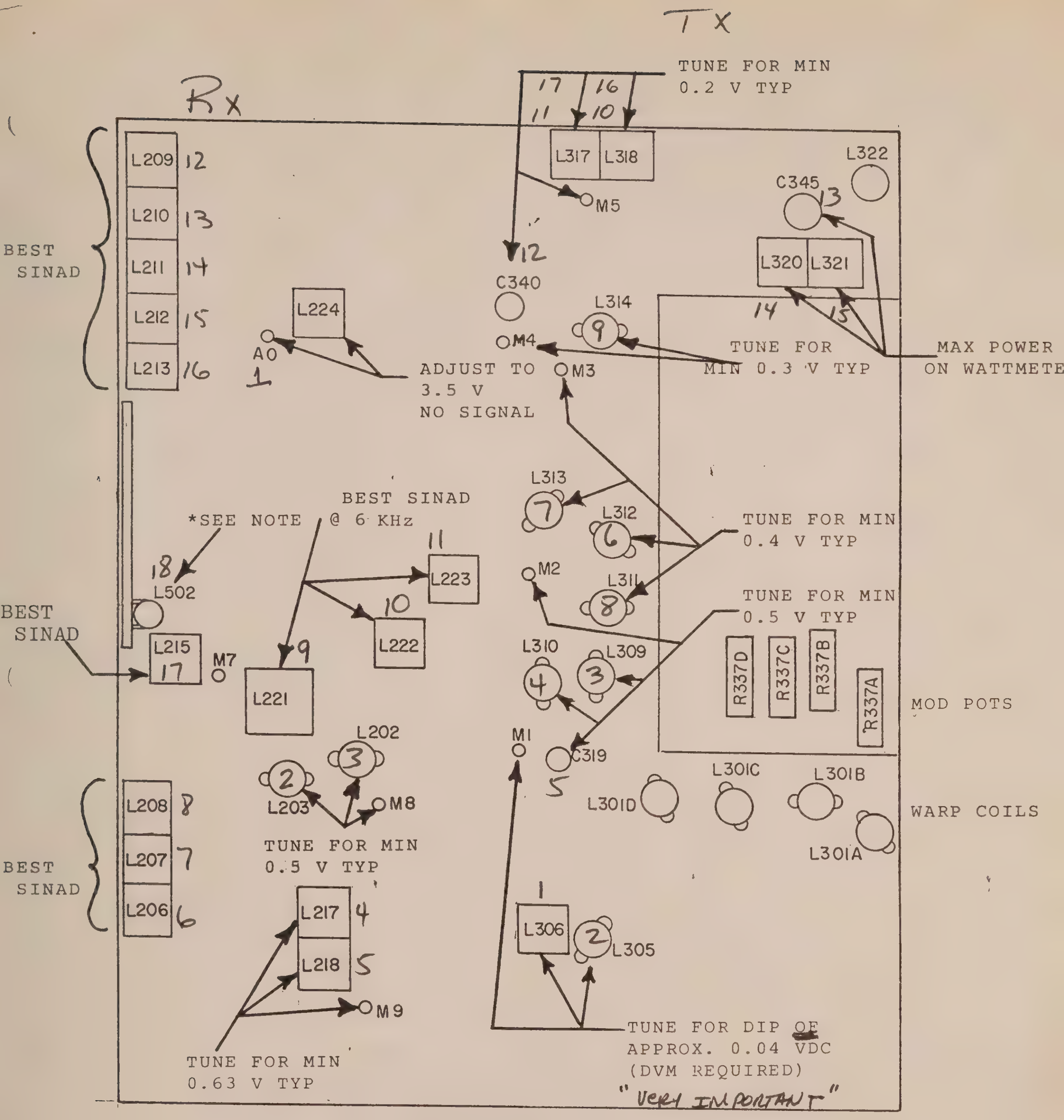
1. ALL CAPACITOR VALUES NOT SPECIFIED OTHERWISE ARE MICRO-FARAD
2. ALL RESISTOR VALUES NOT SPECIFIED OTHERWISE ARE OHMS, ¼ WATT
3. PARTS MARKED WITH (*) ARE VARIABLE WITH MODEL — (SEE PARTS VARIABLE CHART)
4. PART NUMBERS INDICATE LOCATION
   - 0-99 CHASSIS MOUNTED PARTS
   - 100-199 CONTROL PANEL
   - 200-299 VCO BOARD
   - 300-399 PA BOARD
   - 400-499 RECEIVER SECTION (MAIN BOARD)
   - 500-599 TRANSMITTER SECTION (MAIN BOARD)
   - 600-699 SYNTHESIZER SECTION (MAIN BOARD)
5. ⬡ DENOTES PIN LOCATED ON P.C. BOARD
   - ☐ DENOTES CIRCUIT TIE POINT
   - o͡JUo DENOTES SOLDERED IN JUMPERS
   - o–JU–o DENOTES HARDWIRE JUMPERS-USER SELECTED
   - ←JO→ DENOTES PLUGGED IN JUMPERS (OPTIONS)
   - —·— DENOTES BOARD BOUNDARIES
   - – – – – DENOTES OPTION VARIATIONS
6. THIS SCHEMATIC IS USED IN CONJUNCTION WITH P.C. BOARD 604-281, PARTS PLACEMENT 604-282, ARTWORK 604-280, PARTS OVERLAY 604-283, SOLDER MASK 604-284
7. P.A BOARD 604-254, VCO BOARD 504-441.

	XLU-152	UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES TOLERANCES ARE	APPROVALS	DATE
			DRAWN DCD	12 80
			CHECKED	
		MATERIAL	ENGR SDRA	24 Feb 81
NEXT ASSY	USED ON	FINISH		
APPLICATION		DO NOT SCALE DWG		

Regency COMMUNICATIONS INC
SATELLITE BEACH, FLORIDA 32937

— SCHEMATIC —
XLU-152

SIZE E | PART NUMBER 704-118 | REV K
SCALE | SHEET 1 OF 1


TX
TUNE FOR MIN
0.2 V TYP
17
16
11
10
Rx
L317
L318
L322
C345
13
M5
L209
12
L210
13
L211
14
L212
15
L213
16
BEST
SINAD
12
L320
L321
C340
L314
14
15
L224
M4
9
TUNE FOR
MAX POWER
A0
1
ADJUST TO
3.5 V
NO SIGNAL
M3
MIN 0.3 V TYP
ON WATTMETE
L313
7
BEST SINAD
@ 6 KHz
*SEE NOTE
L312
6
TUNE FOR MIN
0.4 V TYP
11
L223
18
M2
L311
8
TUNE FOR MIN
0.5 V TYP
L502
10
BEST
SINAD
L222
L215
17
M7
9
L221
L310
4
L309
3
R337D
R337C
R337B
R337A
MOD POTS
L202
3
M1
C319
5
L301C
L301B
L203
2
M8
L301D
WARP COILS
L301A
L208
8
L207
7
TUNE FOR MIN
0.5 V TYP
BEST
SINAD
L206
6
L217
4
1
L306
2
L305
L218
5
M9
TUNE FOR MIN
0.63 V TYP
TUNE FOR DIP OF
APPROX. 0.04 VDC
(DVM REQUIRED)
"Very IMPORTANT"

TRANSMITTER & RECEIVER TUNING POINTS

*PRESET WITH CORE ALL THE WAY INTO COIL. AFTER RADIO IS COMPLETELY TUNED, DETUNE CORE TO THRESHOLD OF LOSING SENSITIVITY.

800MHZ MCE 20 SERIES

PART # 2358-0000-000 REV B

HC 25/U

DRIVE 2.0 MW

FREQ 16.79167 to 18.125 Cal 25°C is ±.0015

TOL 0°C to +60C is ± 005%

CRYSTAL $$\frac{\text{TX FREQ}}{48}$$

LOAD 32PF

H C_1 = 0.025PF ± 10% C_0 = 5.5 PF ± 10%

SER RESISTANCE is 30 OHMS **MAX**

REGENCY COMMUNICATIONS
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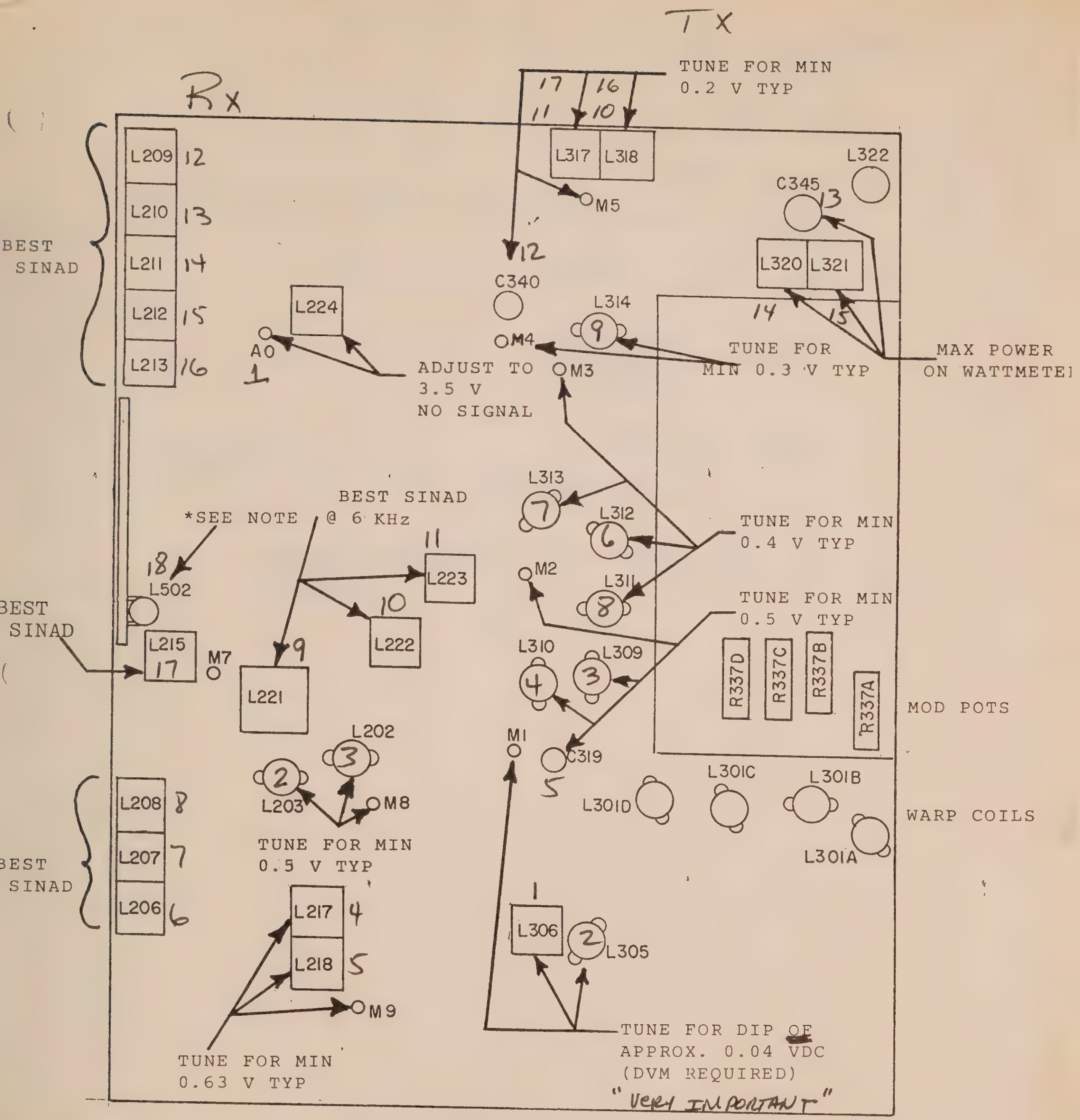


TX
TUNE FOR MIN
0.2 V TYP
17
16
11
10
Rx
L317
L318
L322
C345
13
M5
12
L320
L321
C340
L314
9
14
15
L209 12
L210 13
L211 14
L212 15
L213 16
BEST
SINAD
L224
A0
1
M4
TUNE FOR
MIN 0.3 V TYP
MAX POWER
ON WATTMETE
ADJUST TO
3.5 V
NO SIGNAL
M3
L313
7
BEST SINAD
@ 6 KHz
*SEE NOTE
L312
6
TUNE FOR MIN
0.4 V TYP
11
L223
18
L502
M2
L311
8
TUNE FOR MIN
0.5 V TYP
BEST
SINAD
10
L222
L215
17
M7
9
L221
L310
4
L309
3
R337D
R337C
R337B
R337A
MOD POTS
L202
3
M1
C319
5
L301C
L301B
L203
2
M8
L301D
WARP COILS
L301A
L208 8
L207 7
L206 6
BEST
SINAD
TUNE FOR MIN
0.5 V TYP
L217 4
L218 5
1
L306
2
L305
M9
TUNE FOR MIN
0.63 V TYP
TUNE FOR DIP OF
APPROX. 0.04 VDC
(DVM REQUIRED)
"VERY IMPORTANT"

TRANSMITTER & RECEIVER TUNING POINTS

*PRESET WITH CORE ALL THE WAY INTO COIL. AFTER RADIO IS COMPLETELY TUNED, DETUNE CORE TO THRESHOLD OF LOSING SENSITIVITY.

800MHZ MCE 20 SERIES

PART # 2358-0000-000 REV B

HC 25/U

DRIVE 2.0 MW

FREQ 16.79167 to 18.125 Cal 25°C is ±.0015

TOL 0°C to +60C is ±.005%

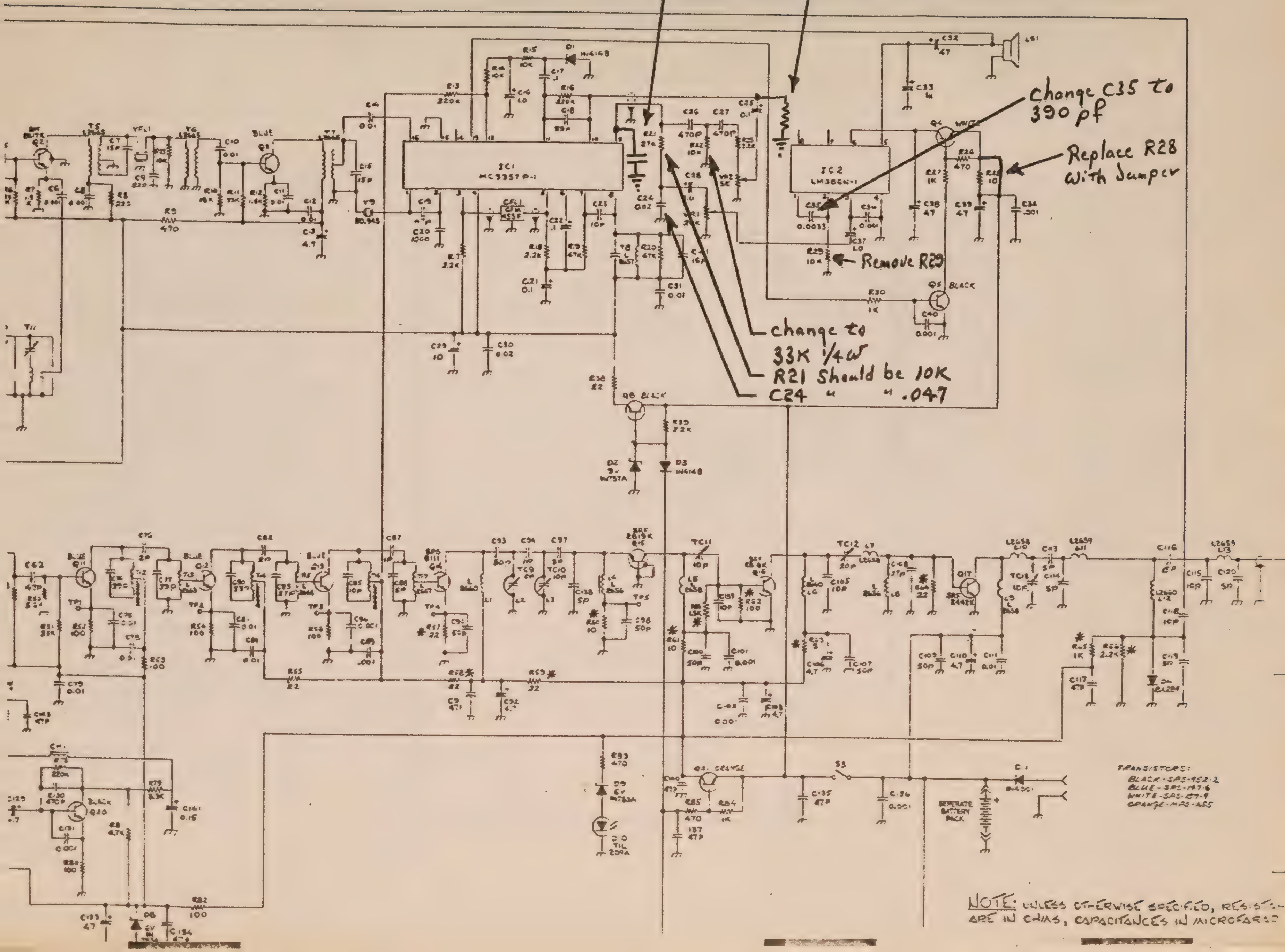
CRYSTAL $\frac{\text{TX FREQ}}{48}$

LOAD 32PF

C_1 = 0.025PF ± 10% C_0 = 5.5PF ± 10%

Ser Resistance is 30 OHMS **MAX**

4-10 SCHEMATIC


IC1
MC3357P-1
IC2
LM386N-1
LS1
Q1
Q3 BLUE
Q4 WHITE
Q5 BLACK
Q8 BLACK
Q11 BLUE
Q12 BLUE
Q13 BLUE
Q15
Q16
Q17
Q20 BLACK
Q21 ORANGE
D1 1N4148
D2
D3 1N4148
R21 27k
R22 10k
R28 10
R29 10k
R30 1K
C24 0.02
C35 0.0033
C26 470P
C27 470P
CF1
S3
SEPERATE BATTERY PACK

add 470pf

add 1M 1/4W

Change C35 to 390 pf

Replace R28 With Jumper

Remove R29

change to 33K 1/4W

R21 Should be 10K

C24 " " .047

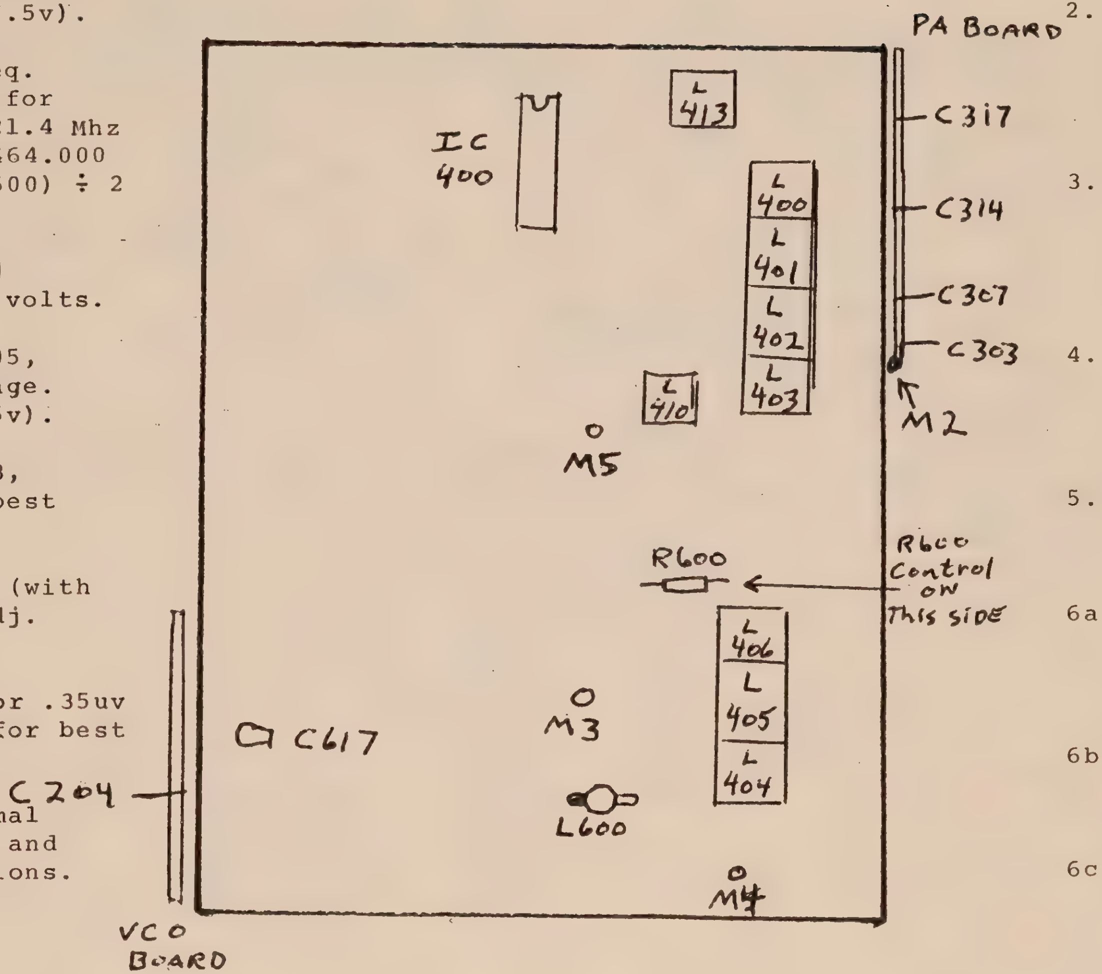
TRANSISTORS:
BLACK - SPS-952-2
BLUE - SPS-147-6
WHITE - SPS-57-9
ORANGE - MPS-A55

NOTE: UNLESS OTHERWISE SPECIFIED, RESIST
ARE IN OHMS, CAPACITANCES IN MICROFAR

XLU TUNE UP

RX

1. At M3 adj. C204 for 6.5 volts.
2. At M4 adj. L600 for min. voltage (approx. +7.5v).
3. At R600 (with a freq. counter) adj. C617 for operating freq. - 21.4 Mhz ÷ 2. E.G. F1 Rx 464.000 Mhz - 21.4 = (442.600) ÷ 2 = 221.300 MHz.
4. At pin 10 of 1C 400 adj. L415 for +3.5 volts.
5. At M5 adj. L404, 405, 406, for min. voltage. (approx. +7.0 - 7.5v).
6. Adj. L406, 410, 413, 400, 401, 402 for best 12 db Sinad.
7. At pin 5 of 1C 400 (with a freq. counter) adj. C617 for 455 KHz.
8. Re-set generator for .35uv and repeat step 6 for best 12 db Sinad.
9. Check unit for normal quieting, squelch, and tone decode operations.


PA BOARD
C317
C314
C307
C303
M2
L 413
IC 400
L 400
L 401
L 402
L 403
L 410
M5
R600
R600 Control on This side
L 406
L 405
L 404
C617
M3
L600
M4
C204
VCO BOARD

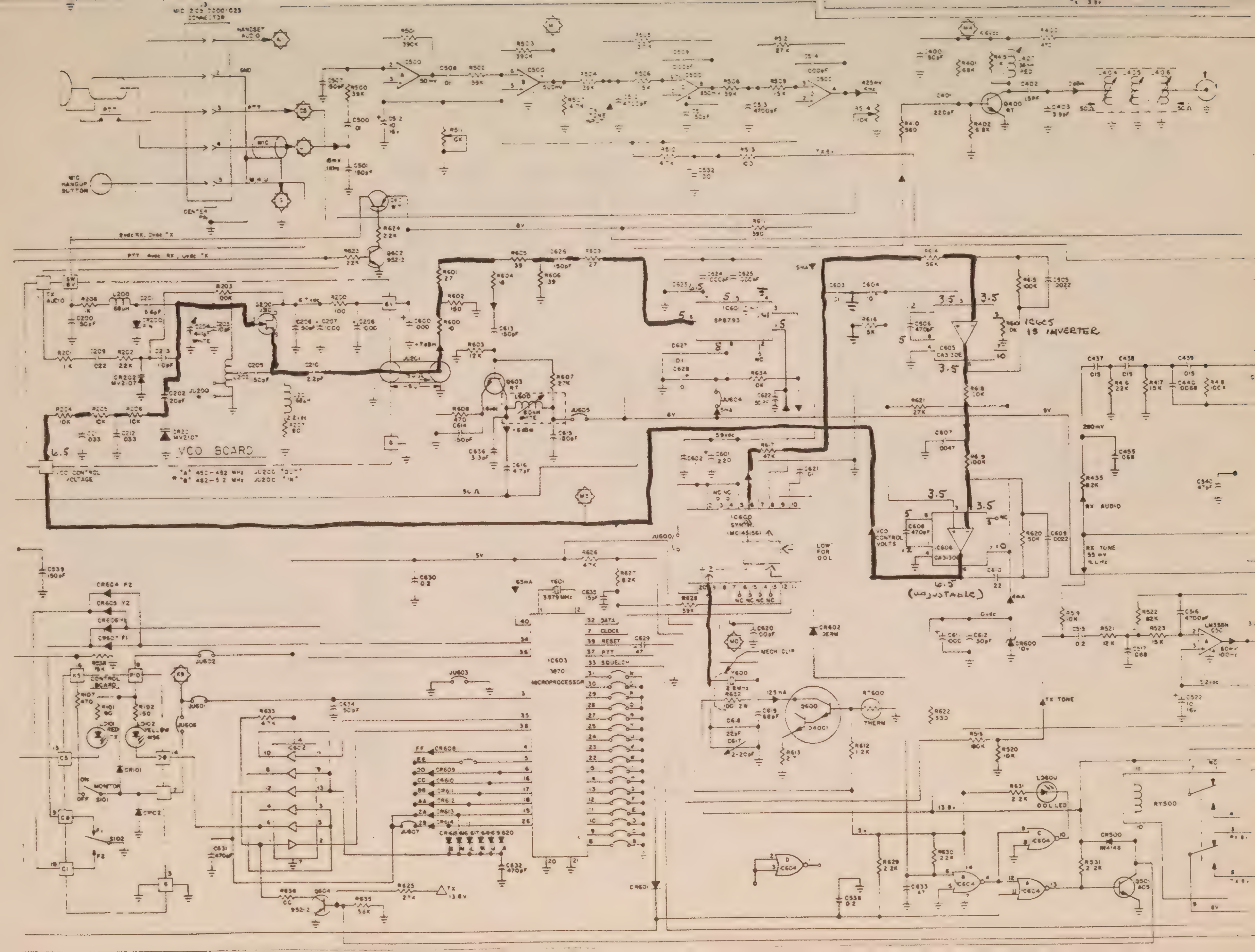
TX

1. At M3 check voltage (approx. +5.0v - 5.5v).
2. At M2 adj. L501, 502, 600 and C504 for max. voltage (approx. +1.5v - +4.0v).
3. Adj. C303, 307, 314, 317 on PA deck for best power @ min. current.
4. Repeat steps 2 and 3 for best power and efficiency.
5. Adj. C617 for proper operating frequency.

6a. Adj. R532 for tone deviation (if used) 500-750 hz.

6b. Adj. R514 for mic deviation 5 KHz maximum.

6c. Adj. R511 for best symmetry.


MIC 2C9 3300-023 CONNECTOR
HANDSET AUDIO
MIC HANGUP BUTTON
GND
PTT
CENTER
R501 390K
R503 390K
C500 .01
C501 150pF
R500 39K
C508 .01
R502 39K
R504 39K
R506 5K
R508 39K
R509 15K
R512 27K
R514 10K
R511 GK
425mV
R610 390
R624 22K
R623 22K
Q622 952-2
8V
PTT 8vdc RX, 0vdc TX
8vdc RX, 0vdc TX
C400 5CpF
R401 68K
R410 560
C401 220pF
Q400 RT
R402 6.8K
C402 15pF
C403 3.9pF
L404
L405
L406
50Ω
TX AUDIO
R208 1K
L200 68uH
C200 50pF
R203 100K
C201 5.6pF
R201 1K
C209 C22
R202 22K
CR202 MV2107
C213 10pF
C202 20pF
C205 50pF
L202
JU200
R204 10K
R205 10K
R206 10K
C211 .033
C212 .033
CR201 MV2107
VCO BOARD
"A" 450-482 MHz JU200 "OUT"
"B" 482-512 MHz JU200 "IN"
VCO CONTROL VOLTAGE
6.5
Q200
C206 50pF
C207 1000
R200 100
C208 .001
C210 2.2pF
JU201
R601 27
R602 150
R600 10
C600 .001
+7dBm
R605 39
C626 150pF
R629 27
R604 10
R606 39
C613 150pF
R603 12K
Q603 RT
R607 27K
L600 60nH WHITE
R608 470
C614 150pF
C636 3.3pF
C616 4.7pF
C615 150pF
JU605
50 Ω
C624 .001pF
C625 .001pF
C623
IC601 SP8793
C627
C628
R634 10K
C622 50pF
JU604
5mA
C603 .01
C604 .01
R616 5K
C606 470pF
C605 CA3130E
R615 100K
C505 .0022
R614 56K
R610 10K
IC605 IS INVERTER
3.5
R618 10K
R621 27K
C607 .0047
R619 100K
C602
C601 220
59vdc
R617 47K
C621 .01
NC NC
IC600 SYNTH. (MC145156)
VCO CONTROL VOLTS
C608 470pF
C606 CA3130E
R620 50K
C609 .0022
C610 22
6.5 (adjustable)
4mA
LOW FOR OOL
JU600
5V
R626 47K
R627 8.2K
C630 .02
65mA
Y601 3.579 MHz
C635 15pF
R628 39K
32 DATA
7 CLOCK
39 RESET
37 PTT
33 SQUELCH
C629 47
IC603 3870 MICROPROCESSOR
C620 100pF
MECH CLIP
Y600
2.8 MHz
R632 100 2W
C619 68pF
C618
C617 2-20pF
125mA
Q600
Q401
RT600 THERM
R613 2.7
R612 1.2K
CR602 ZENER
C611 .001
C612 50pF
CR600 10V
R622 330
C437 C19
C438 C15
C439 .015
R416 22K
R417 15K
C440 .0068
R418 10CK
280mV
C455 .068
R435 82K
RX AUDIO
C540 47pF
RX TONE 55mV 1kHz
R519 10K
C519 .02
R521 12K
R522 82K
C516 4700pF
R523 15K
C517 .068
LM358N
C522 10 16v
TX TONE
R518 10K
R520 10K
C539 150pF
CR604 F2
CR605 Y2
CR606 Y1
CR607 F1
R538 15K
CONTROL BOARD
R107 470
R101 90
R102 150
CR101
CR102
DS101 RED TX
DS102 YELLOW BSC
ON MONITOR OFF S101
S102 F1 F2
JU602
JU603
JU601
JU606
C634 50pF
R633 47K
IC602
C631 470pF
C632 470pF
JU607
CR608
CR609
CR610
CR611
CR612
CR613
CR614
CR615 616 617 618 619 620
Q604 952-2
R634 CC
R635 56K
R625 27K
TX 13.8V
CR601
C638 .02
R629 2.2K
R630 22K
C633 47
IC604
R631 2.2K
LD600 OOL LED
13.8V
RY500
CR500 IN4148
R531 2.2K
Q501 AC9

XLH 252
XLH 257

XLH 252/257 TUNE-UP

RX

1. At M5 adj. L201 for peak voltage (approx. +3.5 - +4.0v at power up freq.)

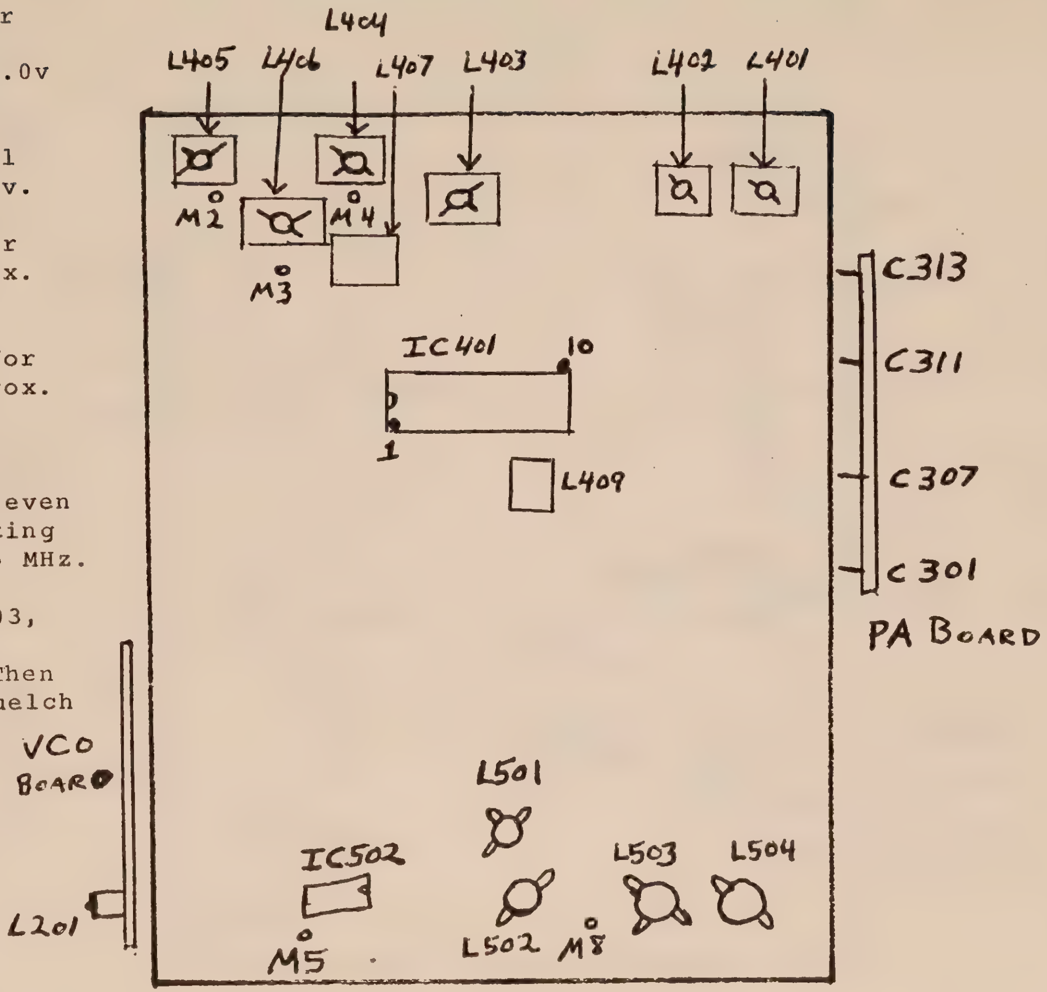
2. At Pin 10 of IC 401 adj. L409 for +3.5v.

3. At M2 adj. L405 for min voltage (approx. +1.5v)

4. At M3, adj. L406 for peak voltage (approx. +2.0v).

5. At M4 with a freq. counter adj. C518 even C520 odd to operating freq. Less 10.695 MHz.

6. Adj. L401, 402, 403, 404, 407 for 12DB Sinad at .35uv. Then check quieting squelch and decode.


L404
L405
L406
L407
L403
L402
L401
M2
M4
M3
C313
C311
C307
C301
PA BOARD
IC401
10
1
L409
VCO BOARD
L201
IC502
M5
L501
L502
M8
L503
L504

TX

1. At M8 adj. L501 and L502 for peak voltage (approx. +.8 to +.9v)

   Adj. L503 for minimum voltage (approx. +.4 to +.5v)

   Adj. L504 for peak voltage (approx. +.65 to +.8v)

2. Adj. P.A. Deck Trimmers C301, 307, 311, 313 for max. power output at minimum current.

3. Repeat Steps #1 and #2 for best power at min. current.

MCL 60 TUNE-UP

RX

1. At A0 (no signal) adj. L209 for 3.5v.

NOTE: All other Rx adj. are done with Sig. Gen. set up at Tune up freq. modulated with 1 KHz of tone @ 3KHz deviation unless otherwise stated.

2. Adj. L211 for best 12 db Sinad.

3. Adj. L205 for best 12 db Sinad.

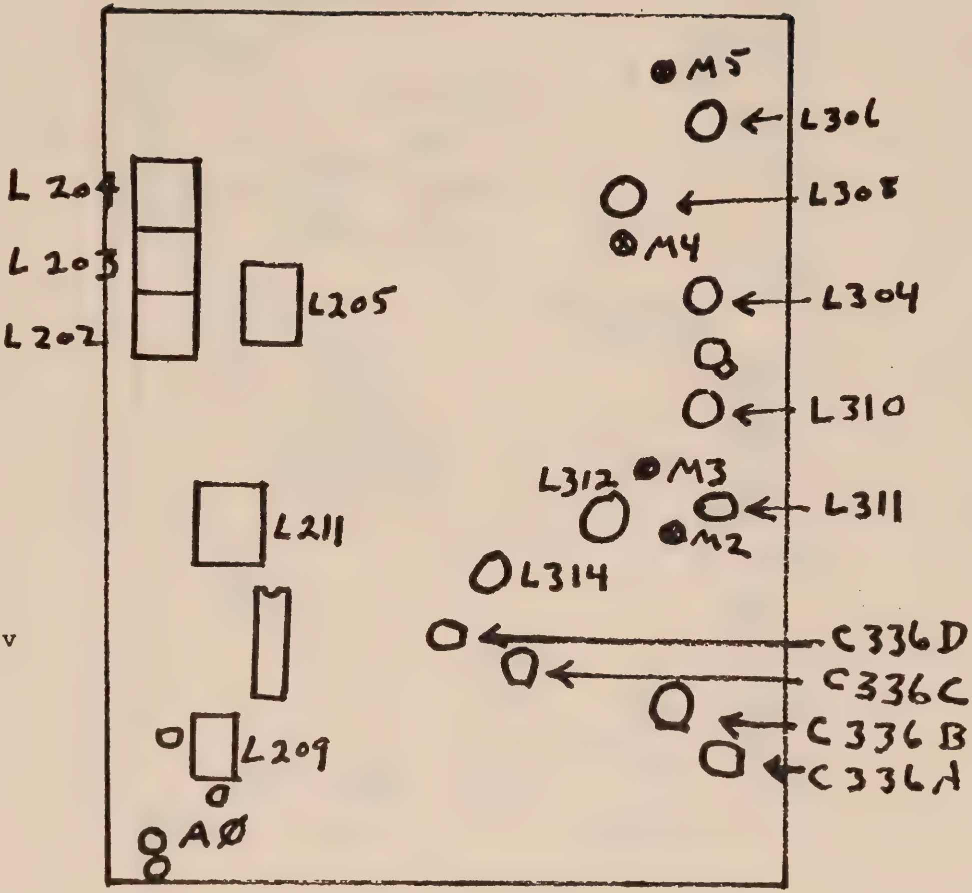
4. Adj. L202, 203, 204, for best 12 db Sinad.

NOTE: Set Sig. Gen. for .5uv level.

5. Repeat Steps 2, 3, and 4.

6. Sig. Gen. should read no greater than .35 uv for 12 db Sinad.

7. Check unit for proper quieting and squelch.


L204
L203
L202
L205
L211
L209
A0
M5
L306
L308
M4
L304
L310
L312
M3
L311
M2
L314
C336D
C336C
C336B
C336A

TX

1. Pre-tune C336 as shown.

2. Pre-tune L314 10 turns C.W. from top of core.

3. At M3 adj. L312 for a slight dip in volt. (approx. .1 - .3v).

   Adj. L314 for min. voltage (approx. +9.5v).

   Adj. L311 for max. voltage (approx. +10.0v).

   Adj. L310 for min. voltage (approx. +9.0v).

4. At M4 adj. L304 for max. voltage (approx. +9.5v).

   Adj. L308 for min. voltage. (approx. +8.5 - 9.0v).

5. Adj. L306 for max. power. Adj. trimmers on P.A. for best power out @ min. current.

6. Repeat steps 4 & 5 for best efficiency.

7. Adj. C336 (a,b,c,d, for proper freq.

MCH 40 TUNE-UP

RX

1. At A0 (no signal) adj L213 for 3.5V.

NOTE: All other RX adj. are done with Sig. Gen. set at tune-up freq. modulated with 1 KHz of tone @ 3 KHz deviation unless otherwise stated.

2. Adj L201 (A,B,C,D) for best 12dB Sinad.

3. Adj L206,208,209, and 211 for best 12dB Sinad.

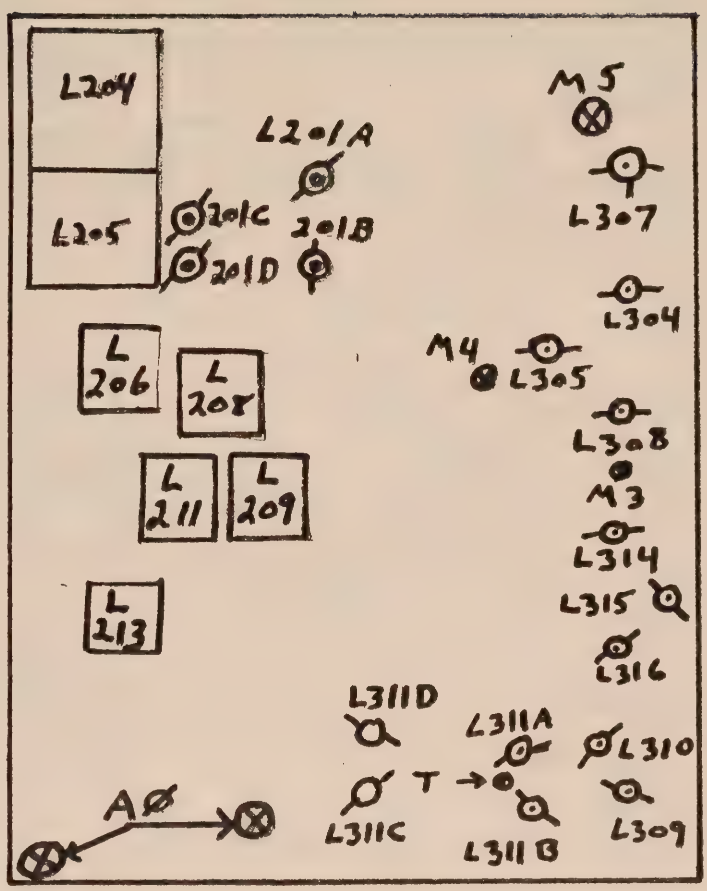
4. Adj L205 and 206 for best 12dB Sinad.

NOTE: Set Sig. Gen. for .5µv level.

5. Adj L201 (A,B,C,D) for best Sinad.

6. Sig. Gen. should read no greater than .35µv for 12dB Sinad.

7. Check unit for proper quieting and squelch.


L204
L205
L201A
201C
201B
201D
L 206
L 208
L 211
L 209
L 213
A0
M5
L307
L304
M4
L305
L308
M3
L314
L315
L316
L311D
L311A
L310
T
L311C
L311B
L309

TX

1. At M3 adj L315,309, 310 and 316 for min voltage (approx. +12 volts).

2. At M4 adj L314 and 308 for min voltage (approx. +11 volts).

3. At M5 adj L304 for min volt (approx. +12.5V).

4. Adj L307 for max. power.

5. Adj C111 and C117 (PA deck) for max. power @ min. current.

6. Repeat Steps 4 and 5 for best efficiency.

7. Adj L311 (A,B,C,D) for proper freq.

MCU

TX

1. At M1 adj. L304-305 for min. voltage (approx. +1.75v)

NOTE: All other Tx adj. are done with meter Common (-) at A+ (meter set a -DCV) unless otherwise stated.

2. At M2 adj L306 & 307 for peak (-) voltage (approx. -2 volts) adj. L310 for min. voltage (approx. -1.5 volts).

3. At M3 adj. L312 & 311 for peak (-) voltage (approx. -6 volts) adj. L316 for min. voltage (approx. -3.5v).

NOTE: Pre-set C348 as shown. ⊖

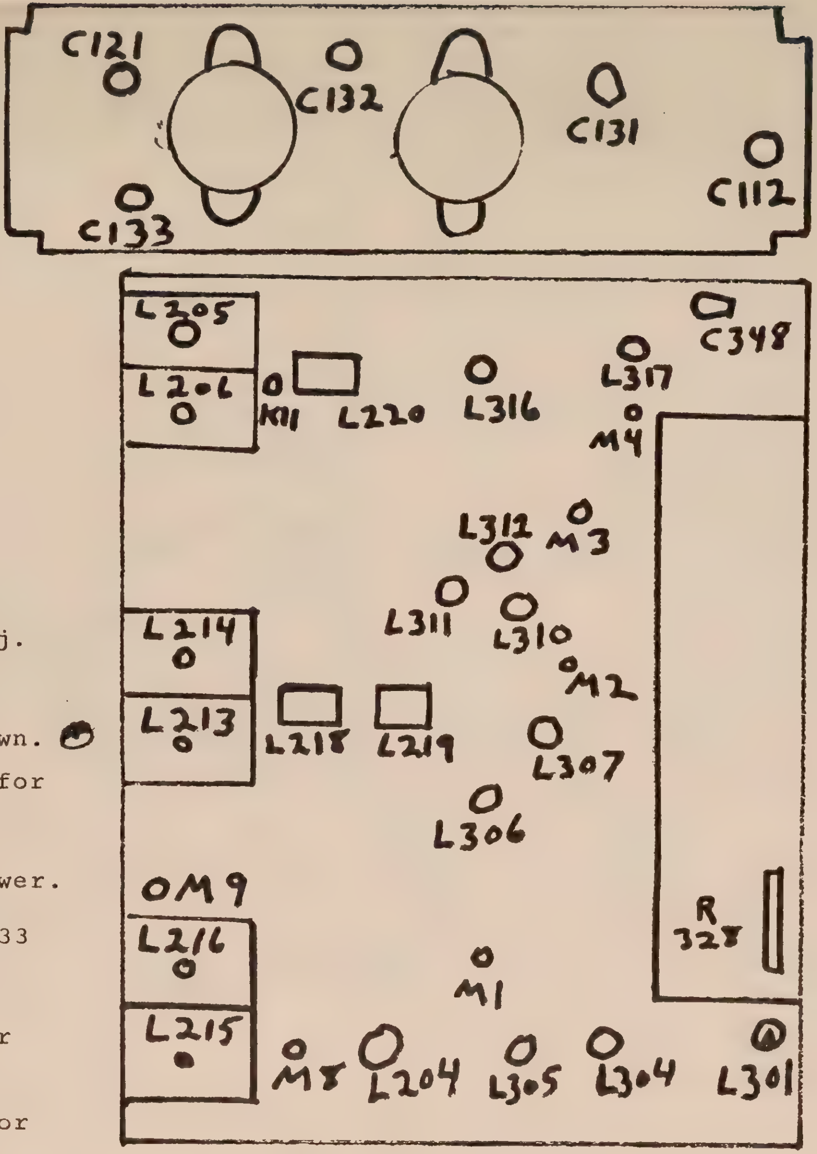
4. At M4 adj. L317 +316 for peak (-) voltage (approx. -1.5 volts)

5. Adj. C348 for max. power.

6. Adj. C112, 121, and 133 for max. power & min. current.

7. Repeat steps 5 & 6 for best efficiency.

8. Adj. L301 (a,b,c,d) for proper freq.


C121
C132
C131
C112
C133
L205
L206
K11
L220
L316
L317
C348
M4
L312
M3
L311
L310
M2
L214
L213
L218
L219
L307
L306
M9
L216
R 328
M1
L215
M8
L204
L305
L304
L301

MCU TUNE UP

RX

1. At pin 10 - 1C 201 (no signal) adj. L220 for +3.5v

NOTE: All other Rx adj. are done with Sig. Gen. set at Tune Up freq. modulated with 1 Khz of Tone @ 3KHz deviation unless otherwise stated.

2. At M8 adj. L204 for min. voltage (approx. +3.4-4.0v).

3. Adj. L205, 206, 212, 213 215 & 216 for best 12db Sinad.

4. Adj. L218, 219 for best 12db Sinad (slugs should be set at top of cores).

NOTE: Set Sig. Gen. for .5uv level.

5. At K11 adj. L201 (a,b,c, d) for +3.5v.

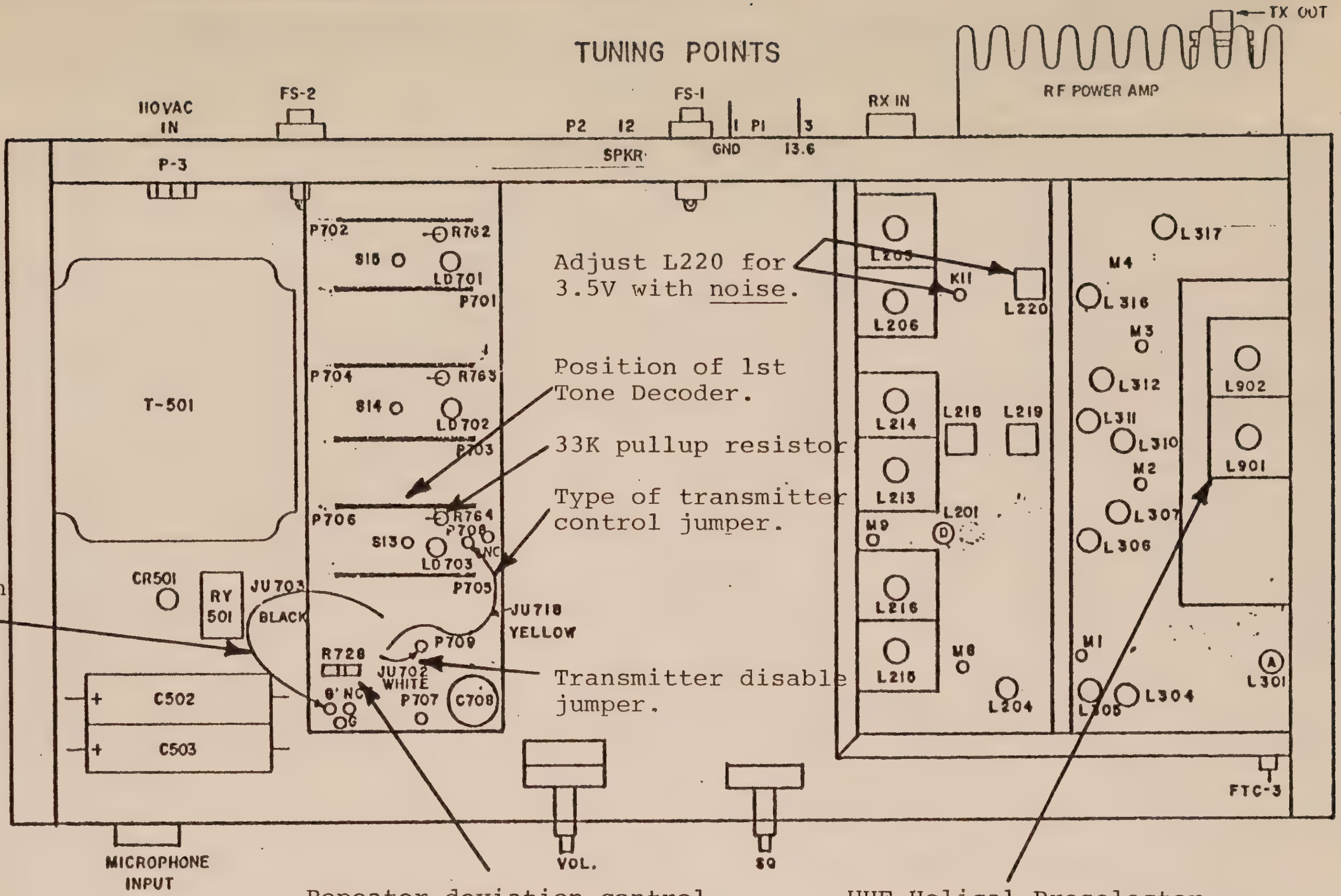
6. Set Sig. Gen. for 6 Khz dev. adj. L218 & 219 for best 12 db Sinad.

NOTE: Reset Sig. Gen. for 3 KHz dev.

7. Sig. Gen. should read no greater than .35uv for 12 db Sinad.

8. Check unit for proper Quieting & Squelch.

TUNING POINTS


TX OUT
RF POWER AMP
110VAC IN
FS-2
P2
12
SPKR
FS-1
1 P1
GND
3
13.6
RX IN
P-3
T-501
CR501
RY 501
C502
C503
MICROPHONE INPUT
P702
R762
S15
LD701
P701
P704
R763
S14
LD702
P703
P706
R764
P708
NC
S13
LD703
P705
JU703
BLACK
JU718
YELLOW
P709
R728
JU702
WHITE
P707
C708
8' NC
G
VOL.
SQ
L205
L206
K11
L220
L214
L213
L218
L219
L201
M9
L216
L215
M8
L204
L317
M4
L316
M3
L312
L311
L310
M2
L307
L306
M1
L305
L304
L301
L902
L901
FTC-3

Adjust L220 for 3.5V with noise.

Position of 1st Tone Decoder.

33K pullup resistor

Type of transmitter control jumper.

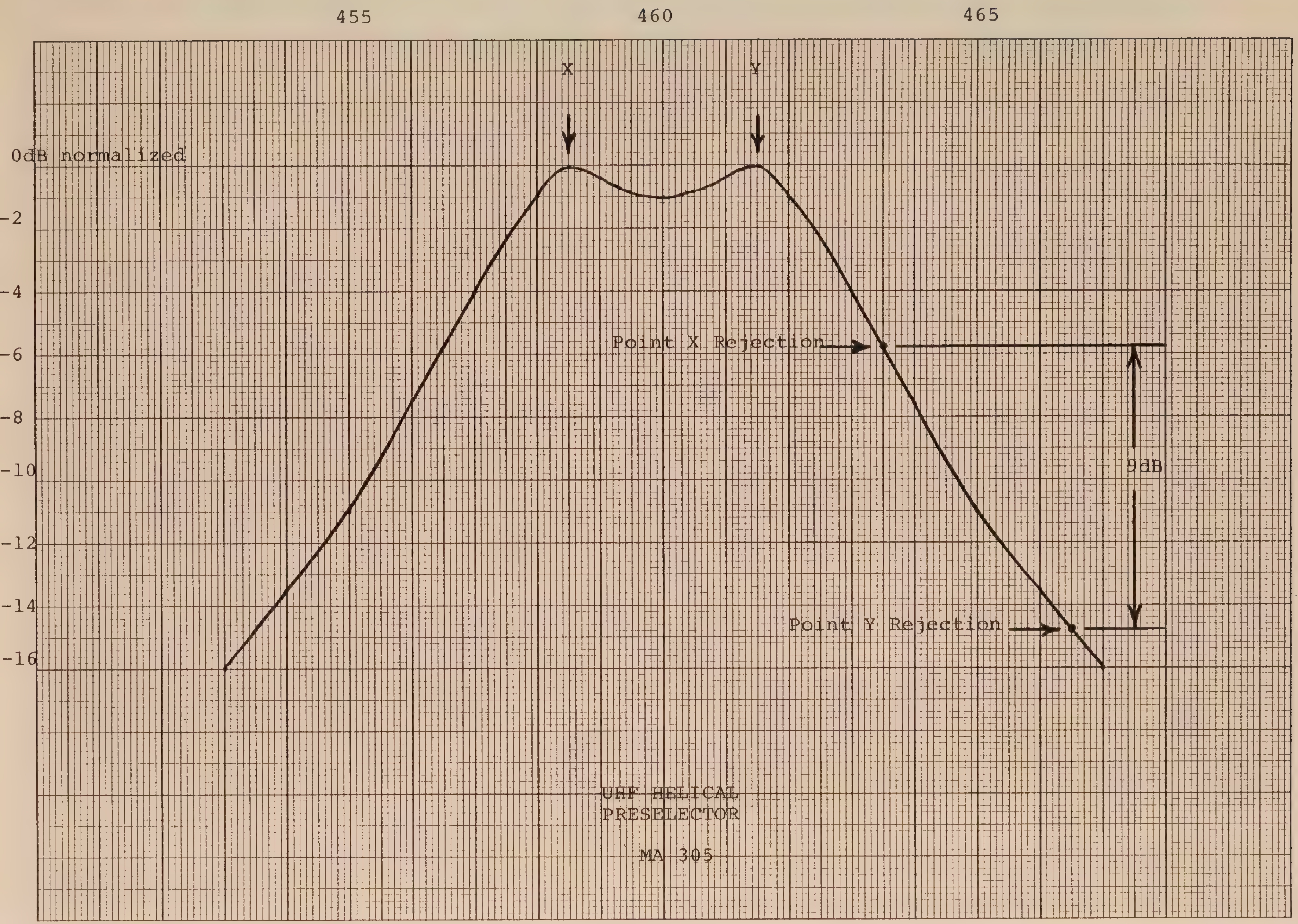
Transmitter disable jumper.

Local control tone selection jumper.

Repeater deviation control
3KHz IN = 3KHz OUT

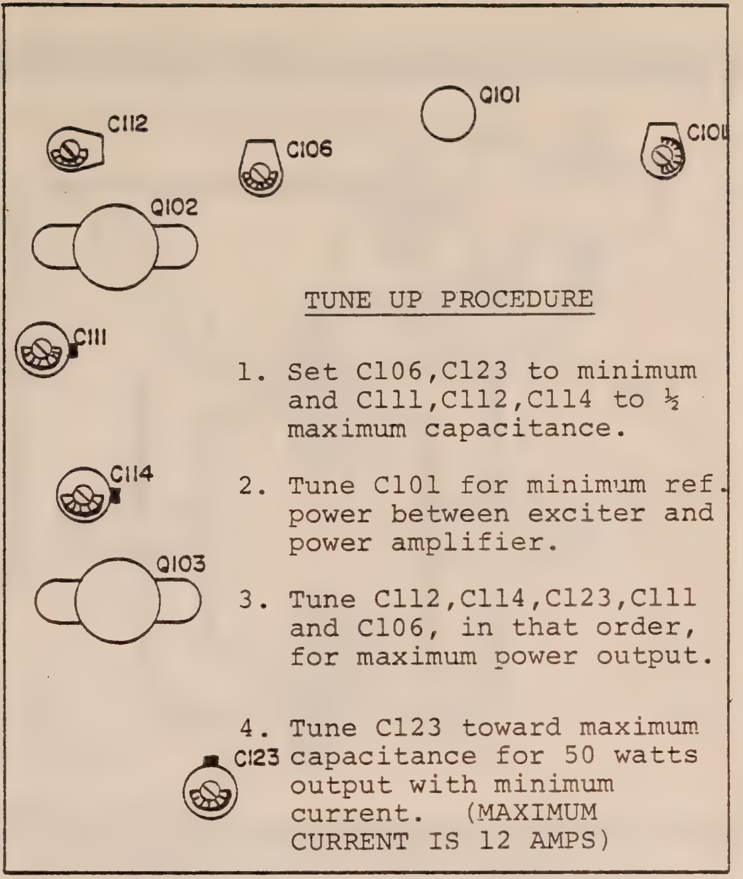
UHF Helical Preselector Slugs must be tuned from LOW frequency side (slugs into coil) then turn CCW for maximum power.

K+E 20 X 20 TO THE INCH • 7 X 10 INCHES
KEUFFEL & ESSER CO. MADE IN U.S.A. 46 1240



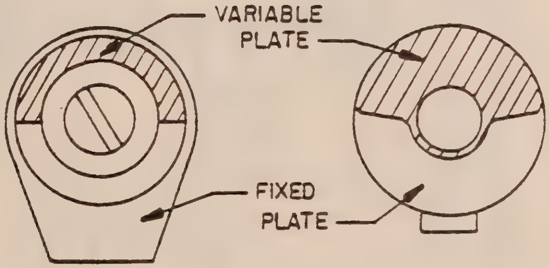
UHF HELICAL
PRESELECTOR

MA 305


Q101
C112
C106
C101
Q102
C111
C114
Q103
C123

TUNE UP PROCEDURE

1. Set C106,C123 to minimum and C111,C112,C114 to ½ maximum capacitance.
2. Tune C101 for minimum ref. power between exciter and power amplifier.
3. Tune C112,C114,C123,C111 and C106, in that order, for maximum power output.
4. Tune C123 toward maximum capacitance for 50 watts output with minimum current. (MAXIMUM CURRENT IS 12 AMPS)

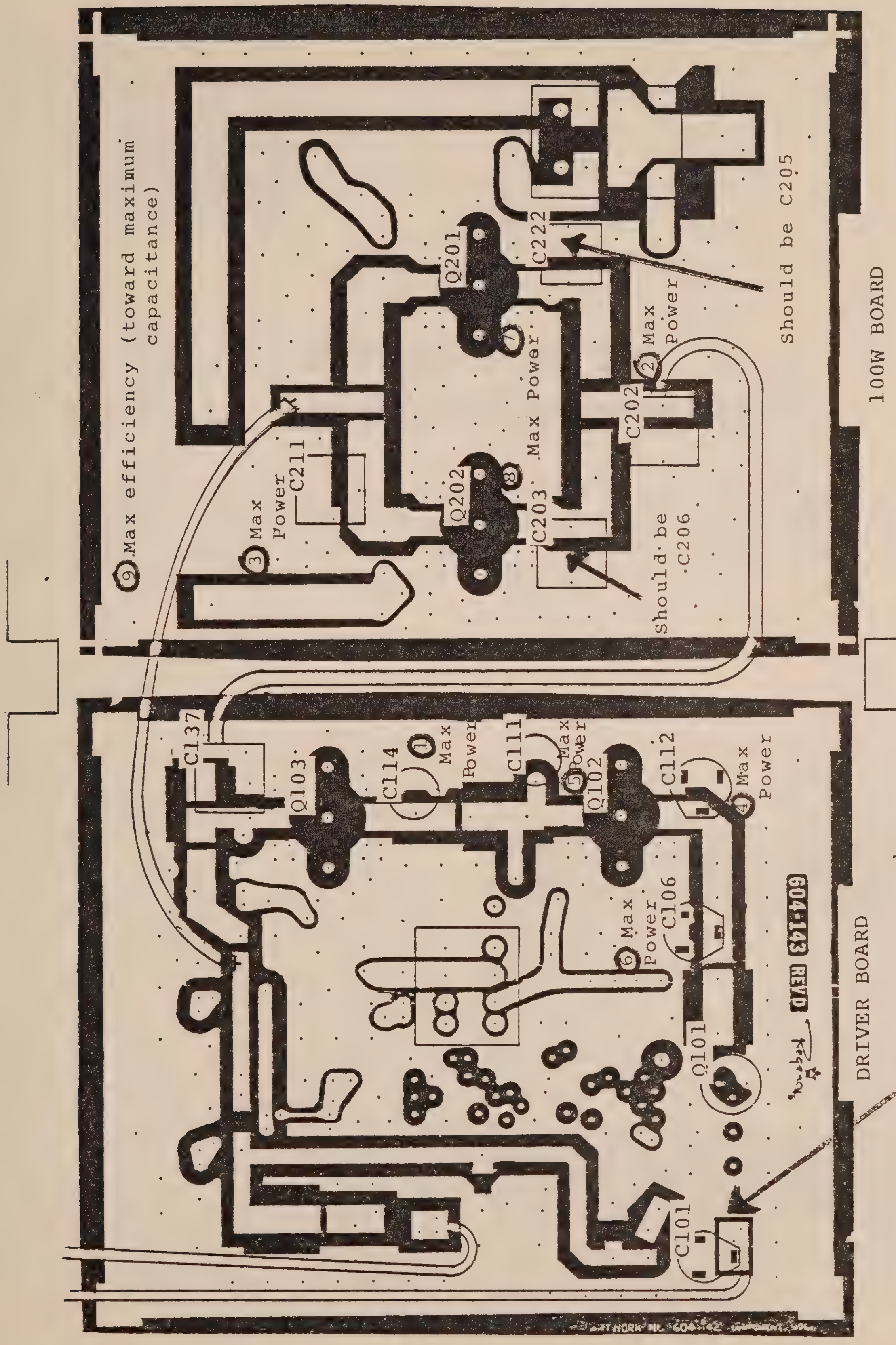

VARIABLE PLATE
FIXED PLATE

STYLE OF C106 & C112   STYLE OF C111, C114 & C123

MINIMUM CAPACITANCE SETTING

TUNING ADJUSTMENT LOCATIONS ACU-45

DRAWN CMcC	DATE 9-24-79	SIZE A	PART NUMBER TP 14-248	REV. B
APPROVED DLF	DATE 11/13/79			
DO NOT SCALE DWG.		SCALE ~		SHEET 4



⑨ Max efficiency (toward maximum capacitance)
③ Max Power
C211
Q202
⑧ Max Power
C203
Should be C206
Q201
C222
Should be C205
C202
② Max Power
100W BOARD
C137
Q103
C114
① Max Power
C111
⑤ Max Power
Q102
C112
④ Max Power
C106
⑥ Max Power
604-143 REV D
Q101
C101
DRIVER BOARD

Minixum reflected power between exciter & power amp.

TUNING CAPACITOR LOCATIONS

ACU100
AASCU100

"REPRINTED COURTESY OF COMMUNICATIONS MAGAZINE" – FEBRUARY 1977

2-Way Technical Refresher Course

What To Do When You're Up to Your Ears in "Intermod"

A two-to-one spacing relationship of interfering signals is almost always the case in real life intermodulation situations. A three-to-two relationship or a four-to-three relationship can also result in "intermod." *Communications's* editorial adviser suggests some cures for these pesky problems.

Engineering Dept.
Regency Communications, Inc.
Satellite Beach, Florida

The need to have several base and repeater stations share a single site gives rise to a host of interference problems. The "landlords" at a number of common transmitter sites spend a great deal of time and energy in beating down these various interference problems, most of which come under "intermodulation interference."

Intermodulation interference is now common enough that almost all land mobile techs know its symptoms.

This article is intended to give some of the basic mathematical relationships that can be used in tracing and curing intermodulation problems.

By far the most common intermod problem is the one called "third order" intermod. It is caused when two very strong signals bearing a certain frequency relationship to each other and to the wanted signal show up at the antenna input of the receiver.

A numerical example of an intermod problem is the quickest way of demonstrating the basic relationships involved. Let's suppose that our receiver is tuned to receive on 454.500 MHz. Assume that there are two very strong signals also present at the antenna. One of the signals is at 454.700 MHz, and one of them is at 454.600 MHz. When these signals get into the receiver, and encounter a non-linear component, additional frequencies are created. These additional frequencies can include the various harmonics of the original signals, and can also include mixing combinations (sums and differences of the frequencies and their harmonics). In the typical third order intermodulation example given, the second harmonic of 454.600 MHz is created; this mixes with the 454.700 MHz signal to create a new signal, 454.500 MHz, as follows:

2nd harmonic of 454.600:	909.200 MHz
	– 454.700 MHz
	454.500 MHz

This 454.500 MHz signal "looks" just like a signal on the wanted channel of 454.500 MHz, and it goes through the selectivity circuits of the receiver, just like the wanted signals.

The above exercise dealt with interfering signals located above the frequency of the wanted channel. Similar results can occur from signals located and properly spaced below the wanted channel frequency. Let's consider the case of strong signals at 454.400 MHz and 454.300 MHz:

2nd harmonic of 454.400	908.800 MHz
Subtract 454.300	– 454.300 MHz
	454.500 MHz

Again, we have a resultant right on the channel frequency.

All of the above math has assumed that the creation of the intermodulation resultant occurred in the receiver

"CAR IS GO TO...
SQWAK
SQRAK!
SCREECH!!
BURGLARY IN PRO...

before the incoming signals had been converted to intermediate frequencies in the receiver. However, in older design receivers, the intermodulation could occur at the receivers high IF, or even at the low IF. Consider the case of a receiver with a 10.700 MHz IF system. The 454.500 wanted channel signal would be converted to 10.700 MHz in the receiver's first converter. The 454.700 MHz and 454.600 signals would be converted to 10.900 and 10.800 MHz respectively. Again the same math exercise:

2nd harmonic of 10.800	21.600 MHz
Subtract 10.900	– 10.900 MHz
	10.700 MHz

As you can see, the resultant is right on the center of the high IF, and it will go right on through the receiver filters and be demodulated, come out the loudspeaker, and annoy the radio users.

Non-Linearity Produces Effects

The aim of modern receiver design is to locate the receiver's selectivity as close to the antenna as possible. All of this second harmonic production and beating of signals can't occur at very low voltage levels. It requires non-linearity in the receiver circuits to produce these effects, and even quite non-linear devices (like bipolar transistors and diodes) don't exhibit significant deviations from linearity on extremely small signal voltages.

Once the signal gets into the receiver circuitry, it is successively amplified by the various receiver circuits, increasing in voltage until it finally reaches the discriminator. If the receiver designer can filter out the unwanted signals before they have been amplified significantly, he can keep the intermodulation problem under control. This is why it is said that the "ideal" receiver would have its selectivity elements located right at the antenna jack.

Two-to-one Spacing Relation

Note that in the above examples, one of the interfering signals was displaced from the wanted channel by 100 kilohertz, and the other one was displaced exactly twice this amount, or 200 kilohertz. The same math would have worked out if we assumed the first interfering signal to be displaced by one megahertz, and the second one by two megahertz. Just as long as the two-to-one spacing relationship is present, we can go through the same exercise and end up with an "intermod" resultant on the wanted channel.

This two-to-one spacing relationship of the interfering signals is almost always the case in real life intermodulation situations. However, intermodulation interference can result when the spacings have a three-to-two relationship. a four-to-three relationship, or many other possibilities. It can also occur as a result of the mixing of three or more interfering signals. Fortunately, these higher order types of intermodulation require substantially higher interfering signal strengths.

Excess Modulation an "Earmark"

What about the modulation on the two signals creating the intermodulation? Go back through the first examples, and assume a plus and minus 5 KHz modulation on the 454.700 MHz signal, and you will find that it shows up on the intermodulation resultant as the same plus and minus 5 KHz modulation. However, 5 KHz of modulation deviation on the 454.700 MHz signal is doubled in the intermodulation process, and shows up on the intermodulation resultant as plus and minus 10 KHz. Thus, the modulation on both of the component interfering signals shows up in the receiver output, but the modulation from one of the signals sounds (and is) twice as much as the normally used modulation deviation. Since modern receivers have bandwidths only a little more than plus and minus 5 KHz, the interfering signal swings out of the receiver bandpass on modulation peaks, and the interference we hear is typically very loud and distorted, and shows the same signs of "squelch clipping" that are observed when receiving a badly overmodulated signal. *This excess modulation on the received interfering signal is one of the earmarks of intermodulation interference.*

Once we have determined the source, or at least the frequencies of the interference, we can consider approaches for dealing with the problem: Install fancy filters, switch to a more modern receiver, move to another site, or just sit down and cry!

Identifying Interfering Signals

The knowledge we have gained through the above math exercises will help us considerably in knowing whether or not the interference being received is of an intermodulation type, and can give us some clues in identifying the interfering signals. If we hear two sets of voices on the interfering signal, with one being much the louder, intermodulation is almost certainly the culprit. If we can identify just *one* of the interfering signals in the combination, the two-to-one relationship can probably help us pinpoint the other. A simple example: Our 454.500 MHz receiver is receiving intermod interference and we caught the I.D. of one of the stations and have identified it as operating on 454.450 MHz. This is 50 MHz removed (on the low side) from our 454.500 MHz channel, so we can expect that the other signal is probably removed by two times 50 KHz, or one half of 50 KHz, also on the low side. Thus, the other culprit is probably on 454.400 or on 454.475 MHz.

Eliminating Unwanted Signals

Now that we know the frequencies of the interfering signals, we can start looking at the various approaches to eliminating the interference. The standard approach is a cavity filter put in the receiver's antenna lead. But before we spend any money on a fancy filter, we had better determine whether or not it will do any good in this case.

Figure 1 shows the selectivity curve of a filter retailing in the $100 region. If anything will do it, this baby ought to! However, in this specific case the two interfering frequencies are so close to the wanted signal that the filter can't even tell the difference between the wanted and the unwanted channels. In this case, the filter would be an impressive and costly paperweight! If, however, the interfering signals had been located one and two megahertz respectively away from our wanted channel, the filter would have attenuated one of them by 12 db, and the other by 18 db.

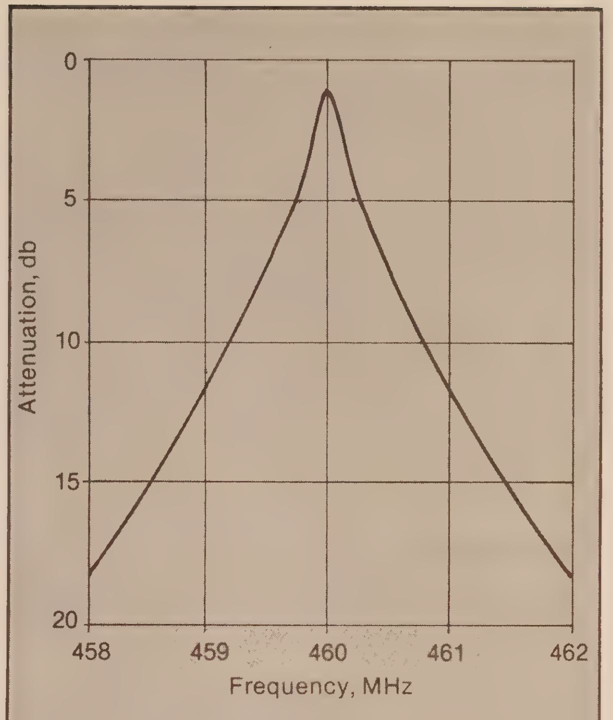


Figure 1.
Typical Coaxial Filter

Even in the second case, however, we should use a little caution before plunking down our money. We know that intermod is the problem, and we know the frequencies of the two signals creating it. But, are we sure where the intermodulation action is taking place? Of course, we would suspect our receiver first, but it may be quite innocent — especially if it is one of the more modern designs with high intermod rejection specs.

If the two offending transmitters are pretty close together, the intermod could be occurring in one (or both) of the transmitters, or in a corroded antenna connection. If so, the interfering signal will be dead on our channel and our filter won't attenuate it any more than it does our wanted signals.

Determining whether the intermod is occurring in the receiver, or is created before it reaches the receiver, has been a puzzler for most technicians. With a little further understanding about the way intermodulation happens, methods for making this determination become apparent.

Intermod Rises at Higher Rate

Back to our initial math example. Notice that before the intermod products could occur, the second harmonic of one of the interfering signals had to be generated. Then this second harmonic had to beat (or mix) against the fundamental of the other interfering signal. With the type of non-linearity involved in real life, it so happens that the amount of intermod signal generated goes up faster than the levels of the two signals. If we double the voltage of both of the two interfering signals, the intermod product voltage will go up by a factor of eight.

Put in decibels, which are easier to work with. A six decibel increase in each of the two signals results in an 18-decibel increase in the intermod resultant. Thus, if we should put a 10 db attenuator pad in the antenna input of our receiver, we would expect it to attenuate the wanted 454.500 MHz signal by 10 db. If we are observing an intermod product *created within the receiver,* the 10 db pad would result in an apparent attenuation of 30 db in the intermod reception. If the intermod product is created outside the receiver (in the antenna system, or in the offending transmitters, or in some nearby piece of rusty wire), the intermod reception would be reduced by only the 10 db of the pad — the same as with any other received signal.

Determining Source of Trouble

This gives us a nifty procedure for determining whether the intermod is happening in the receiver, or is happening elsewhere:

1) Connect a meter to the appropriate receiver limiter test point. The first limiter is preferred if the interfering intermod gives an adequate meter indication.

2) Observe the limiter reading when the intermod is heard.

3) Insert a 3 db pad in the receiver antenna lead. Observe the limiter reading when the intermod is heard.

4) Connect a signal generator operating on the wanted signal frequency to the antenna jack of the receiver, and adjust its output until the same limiter reading observed in step two is obtained.

5) Insert the 3 db pad between the signal generator and the receiver antenna port. Without changing the signal generator output, observe the limiter reading.

6) If the intermod is occurring *outside* the receiver, the limiter readings observed in steps 3 and 5 will be about the same.

7) If the intermod is occurring *inside* the receiver, the limiter reading in step 5 will correspond to a much stronger signal than the reading obtained in step 3.

If a 3 db pad isn't on hand, other size pads could be used. However, don't be surprised if the interference stops entirely when a large size pad is used. Since the pad will cut the intermod by three times the db rating of the pad, a six db pad could result in an 18 db decrease in intermod reception, and a 10 db pad could result in a 30 db decrease.

Replace Old Set if Needed

To keep this article from becoming a book-long treatise on intermod fighting, we're going to assume that the trouble is, indeed, within the receiver. What can we do about it? Of course, we would want to give the receiver a pretty thorough check up — see that the RF and mixer transistors (or tubes in an older set) are in good shape, and that the L.O. injection is normal.

If the receiver is pretty much of an antique, we should definitely consider replacing it with a more modern unit with better intermod specs. How much better? Insert added pads in the receiver antenna lead until the intermod disappears. The amount of attenuation needed is a guide to the amount of improvement required.

Cavity Filter May Do the Job

If the interfering signals are about 1/2 percent or more displaced in frequency from the wanted channel, one of the many available coaxial cavity filters may do the job. Again, we can get an idea of how much attenuation we need at the interfering signals by experimenting with the amount of attenuation pad needed in the receiver antenna lead to remove all traces of the interference. If the filter will provide that amount of attenuation at the nearest of the interfering signals, it will provide still more at the other one, and will eliminate the problem with considerable margin to spare. Simple experimentation with antenna attenuation pads, plus an inspection of the manufacturer's curves on the filters will take the guesswork out of ordering the proper filter.

Since modern receivers already have fairly selective input circuits, many intermod problems can't be solved by adding cavity filters. If the signals are close enough to the wanted channel frequency to get through the receiver filters, they may be too close to filter out with added coaxial filters. To handle this, some quartz crystal manufacturers offer crystal filters that operate clear up through VHF frequencies, and can be placed right in the antenna lead to the receiver. These filters must be ground to the exact channel frequency, and they don't come free with a box of breakfast cereal!

Antenna Pad Could be Answer

In a few special situations, an antenna pad in the receiver antenna line might be all that is needed. This may sound like heresy after all the trouble the designers went to in order to have that last tenth of a microvolt of sensitivity, but there are some cases where it won't degrade the system performance a bit.

Consider the case of a control station for a mobile relay type system; with the directional antenna required by the FCC rules, the receiver probably has a lot more signal coming from the relay than required. A 10 or 20 db pad in the receiver line might still permit perfect reception from the mobile relay station, and will knock out an extremely bad case of intermod. Consider a low band, or a 150 MHz, base station located in the center of a business district. Even if the receiver is capable of a quarter microvolt or better sensitivity, local noise may limit effective sensitivity to something like one or two microvolts. In such a case, six db (or even more) of extra loss in the receiver antenna line might not produce any effective loss of system range, but it could provide the cure for a serious intermod problem.

Just so the people that make those expensive filters won't hate me too much, however, I do want to warn you to *measure* effective system sensitivity both before and after adding the pad, by injecting a signal into the antenna line with the antenna connected.

W = White B = Blue
G = Green Y = Yellow

XLH 252

PRODUCT	PROBLEM	SERVICE BULLETIN #	COLOR
XLH 252	To facilitate 5.26 MHz spacing in half duplex mode.	80-171	G
XLH 252	Self Quieting Spur frequencies	80-180	G
XLH 252	Failure of synthesizer (IC 511) during normal operation.	80-181	G
XLH 252	Excessive low frequency deviation of carrier on transmit when radio is near transmit antenna.	80-182	G
XLH 252	Microprocessor failure due to static electricity in low humidity conditions	80-184	G
XLH 252 Prior to Serial #2147	Transmitter problems when a supply line choke is used.	80-185	G
XLH 252	Excessive low frequency deviation of the carrier on transmit caused by sources such as alternator whine, vibration, etc.	81-194	G
XLH 252	Microphone sensitivity in a noisy environment.	81-199	G
	XLH-257		
XLH 257	Excessive low frequency deviation of the carrier on transmit caused by sources such as alternator whine, vibration, etc.	81-194	G
XLH 257	Microphone sensitivity in a noisy environment	81-199	G

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MCBU 19, 35

PRODUCT	PROBLEM	SERVICE BULLETIN #	COLOR
MCBU 19, 35	No transmitter disable with MA 130 installed	80-189	B
MCBU 19 A, B MCBU 35A, B	No transmitter output power from channel 2 when the ambient temperature is cold.	81-190	B
MCBU 19 MCBU 35 with 704-064 main board	Transmitter unstable, low power transmit, power varies, difficult broadband tuning	81-191	B
MCBU 19, 35	Squelch opens on some radios at cold temperatures	81-197	B
	MCU 10R		
MCU 10R	Audio Transcients	78-0146	B
MCU 10R Tone/Control Board	adding anti-false circuit to tone decoders requiring tone plus carrier to activate repeater.	80-166	W
MCU 10R Tone/Control Board	Improve audio transfer characteristics	80-167	W
	MCCU15R		
MCCU15R	Squelch opens on some radios at cold temperatures	81-0197	B

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MCL 60

PRODUCT	PROBLEM	SERVICE BULLETIN #	COLOR
MCL 60	Replacement on/off controls and squelch controls	79-0162	W
MCL 61A, B, C MCL 64A, B, C	Receiver desense, distortion and squelch blocking in presence of strong signal.	80-0170	W
MCL 61A, B, C MCL 64A, B, C	Deterioration of sound quality due to loss of high frequency response.	80-0173	Y
MCL 30, 60	Problems when using MA 127, 128, or 129	80-0183	W
	XLU 152		
XLU 152	Microphone sensitivity in a noisy environment	81-199	G
XLU 152A	Material change for Q401 from A 4801-3432-300 to A 4801-3434-200	81-200	B
	MCPU SERIES		
MCPU	Setting transmit frequencies on 4 channel radios.	81-201	B

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MCV SERIES

PRODUCT	PROBLEM	SERVICE BULLETIN #	COLOR
MCV 21C	Squelch Lockup	78-0145	G
MCV 20	Shipment of BTH Service Manuals instead of MCV Manuals.	78-0150	G
MCV 21H MCV 21CH MCV 22H MCV 22CH MCV 24H	High Range (162-174 MHz) Micro-Com transmitter not tuning properly	78-0154	G

BTH SERIES

PRODUCT	PROBLEM	SERVICE BULLETIN #	COLOR
BTH 201 BTH 202	Shipping BTH Service manuals instead of MCV manuals to all MCV and BTH users.	78-0150	G
BTH 201B W/MA 116	No encode tone when Tx is keyed.	80-179	W

TRH 200

PRODUCT	PROBLEM	SERVICE BULLETIN #	COLOR
TRH 200	M3 Voltage low or low deviation	81-196	G

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OPTIONS AND TONES

PRODUCT	PROBLEM	SERVICE BULLETIN #	COLOR
MA 56, 57, 70, 91, 93 When used w/remote control	Audio feed through problem on transmit with remote units	78-0147	W
All current models	Available service information	78-0149	W
E & R Tone Wideband Receivers	Filters	78-0151	G
MA 126, MA 79 Handset used with MCH 40, MCU 30	Bassey Transmit Audio	79-0158	W
MA 305 Helical Preselectors	Revised MA 305 Service Manual	79-0159	W
P1412 and MCB/CBS Base Stations	SCR overvoltage circuit failure in P1412	79-0161	W
MA 114, 115, 146, 164 Mic Hangup	Intermittent CTCSS Operation	79-0163	W
MA 116 Board 504-046 REV. A & B	Changes necessary when using in Repeater with tone control board	80-168	B
MA 147 Board 1700-5416-000 Rev. C	False Decoding	80-169	W
MA 177 Imp. Adapter	Hum on transmit and receive audio	80-172	W
P1412 Power Supply	Definition of circuit changes. Revisions A,B,C	80-177	W
MA-116 P.C. Board 504-046 REV. "C" only	Low receive sensitivity after transmitter is keyed.	80-178	W
P1412 Power Supply	Definition of circuit changes. Revision D	80-188	W
MA 318, 178	Transmitter keys when handset is lifted	81-192	W

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OPTIONS AND TONES

PRODUCT	PROBLEM	SERVICE BULLETIN #	COLOR
MA 319	Remote base with tone will not go into monitor mode if used with local microphone.	81-193	W
P1412 Rev. C and D	High line voltage causes Power Supply SCR to fire and shut off output.	81-195	W

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MCU 15, MCU 30

PRODUCT	PROBLEM	SERVICE BULLETIN #	COLOR
MCU 15, MCU 30	Squelched Noise Hiss and poor squelch characteristics	78-0156	B
MCU 30 W/MA 126, MA 79	Bassey Transmit Audio	79-0158	W
MCU 15, 30	JO numbers on schematic are different than option installation instruction.	79-0160	B
MCU 15, 30	Replacements on/off controls and squelch circuits.	79-0162	W
MCU 30 Version I, II	Alternator whine in receiver output	79-0165	G
MCU 30, 30 II	Transient frequency shift when transmitter is keyed.	80- 175	W
MCU 15, 30	Problems when using MA 127, 128, or 129	80-183	W
MCU 34H MCU 18	No Tx output power from channel 2 when the ambient temperature is cold.	81-190	B
MCU-15, 18, 31, 34	Squelch opens on some radios at cold temperatures	81-197	B
	MCU01, MCU04, MCCU-01R		
MCU01 - MCU04 MCCU-01R	Squelch opens on some radios at cold temperatures	81-197	B

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SERVICE BULLETINS

78-0144(G)	MCH-44 with MA-129 and MA-164 or 65 installed noise burst on priority channel.
78-0145(G)	MCV21C Squelch Lock-up
78-0146(B)	MCU10R Audio Transcients
78-0147(W)	MA56, 57, 70, 91, 93 when used with Remote Control Audio feed through problem on Tx with remote units.
78-0148(G)	MCH-40 Wiring of second option switch W/2 options requiring a switch.
78-0149(W)	All current models available service information.
78-0150(G)	MCV20 series, BTH201, BTH202 Shipment of BTH service manuals instead of MCV manuals.
78-0151(G)	E and R Tone Wideband Receivers filters
78-0152(G)	MCH40 Squelch Blocking
78-0153(G)	MCH40B Transmitter Stability and Operating Bandwidth
78-0154(G)	MCV21H, MCV22H, MCV24H, MCV21CH High range (162-174 MHz) Micro-com Tx not tuning properly.
78-0155(G)	MCH40 Squelch Popping under tight squelch conditions, receiver attack and squelch closing time.
78-0156(B)	MCU15, MCU30 Squelch noise hiss and poor squelch characteristics
79-0157(G)	MCH40 New schematic
79-0158(W)	MA126, MA79 Handset used with MCH40, MCU30 Bassey Tx Audio

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SERVICE BULLETINS

80-189(B)	MCBU 19, MCBU 34 No transmitter disable with MA-130 installed.
81-190(B)	MCU 18, MCU 34, 34H, MCBU 19A,B, MCBU 35A, B No Tx output power from Channel 2 when the ambient temperature is cold.
81-191(B)	MCBU15, MCBU30, MCBU19, MCBU35, W/704-064 Main Board. Tx unstable, low power Tx, Power varies, difficult broad band tuning.
81-192(W)	MA-318, MA-178 Tx keys when handset is lifted.
81-193(W)	MA 319 (on back sheet of 81-192) Remote Base W/tone will not go into monitor mode if used with local microphone.
81-194(G)	XLH 252, XLH 257 Excessive low frequency deviation of the carrier on Tx caused by sources such as alternator whine, vibration, etc.
81-195(W)	P1412 Power Supply - Revision C and D High line voltage causes Power Supply SCR to fire and shut off output.
81-196(G)	TRH 200 M3 voltage low or low deviation.
81-197(B)	MCU15, 18, 31, 34 MCBU 19, 35 MC01, MC04, MCU01R, MCU15R Squelch opens on some radios at cold temperatures.
81-198	Not Released.
81-199(G)	XLH 252, XLH 257, XLU 152 Microphone sensitivity in a noisy environment.
81-200(B)	XLU152A Material change for Q401, from A 4801-3432-300 to A4801-3434-200
81-201(B)	MCPU Series (Portable) Setting Tx frequencies on 4 channel radios.

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SERVICE BULLETINS

79-0159(W)	MA-305 helical Preselectors Revised MA-305 service manual.
79-0160(B)	MCU-15, MCU-30 JO numbers on schematic are different than option installation instruction.
79-0161(W)	P1412 Power Supply and MCB/CBS Base Stations SCR overvoltage circuit failure in P1412 power supplies.
79-0162(W)	MCH-40, MCU-30, MCU-15, MCL-60 Replacement on/off controls and squelch controls.
79-0163(W)	Mic Hang Up W/MA-114, 115, 146, 164 Intermittent CTCSS operation.
79-0164(B)	MCU-30 Version I and II Alternator Whine in Receiver output.
79-0165(G)	MCH-40 Version I and Version II Alternator Whine in Receiver output
80-166(W)	MCU10R Tone/Control Board Adding anti-false circuit to tone decoders requiring tone plus carrier to activate repeater.
80-167(W)	MCU-10R Tone/Control Board Improve audio transfer characteristics.
80-168(B)	MA-116 Encoder/Decoder Board 504-046 Rev. A & B. Changes necessary when using in repeater with tone control board.
80-169(W)	MA-147, 2805 Tone Decoder, P.C. Board 1700-5416-000 Rev. C. False Decoding
80-170(W)	MCL-61A,B,C, MCL-64A,B,C Receiver desense, distortion and squelch blocking in presence of strong signal.
80-171(G)	XLH-252 to facilitate 5.26 MHz spacing in half duplex mode.
80-172(W)	MA-177 Impedence adaptor hum on Tx and Rx audio.
80-173(Y)	MCL-61, A,B,C, MCL-64A,B,C Deterioration of sound quality due to loss of high frequency response.

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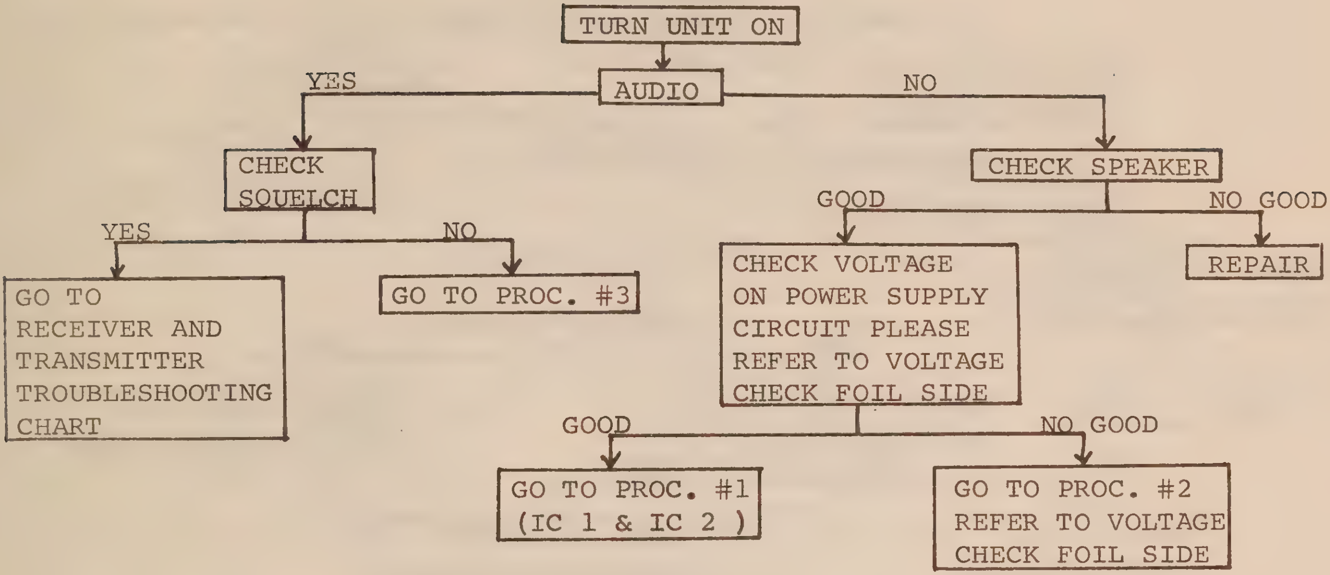
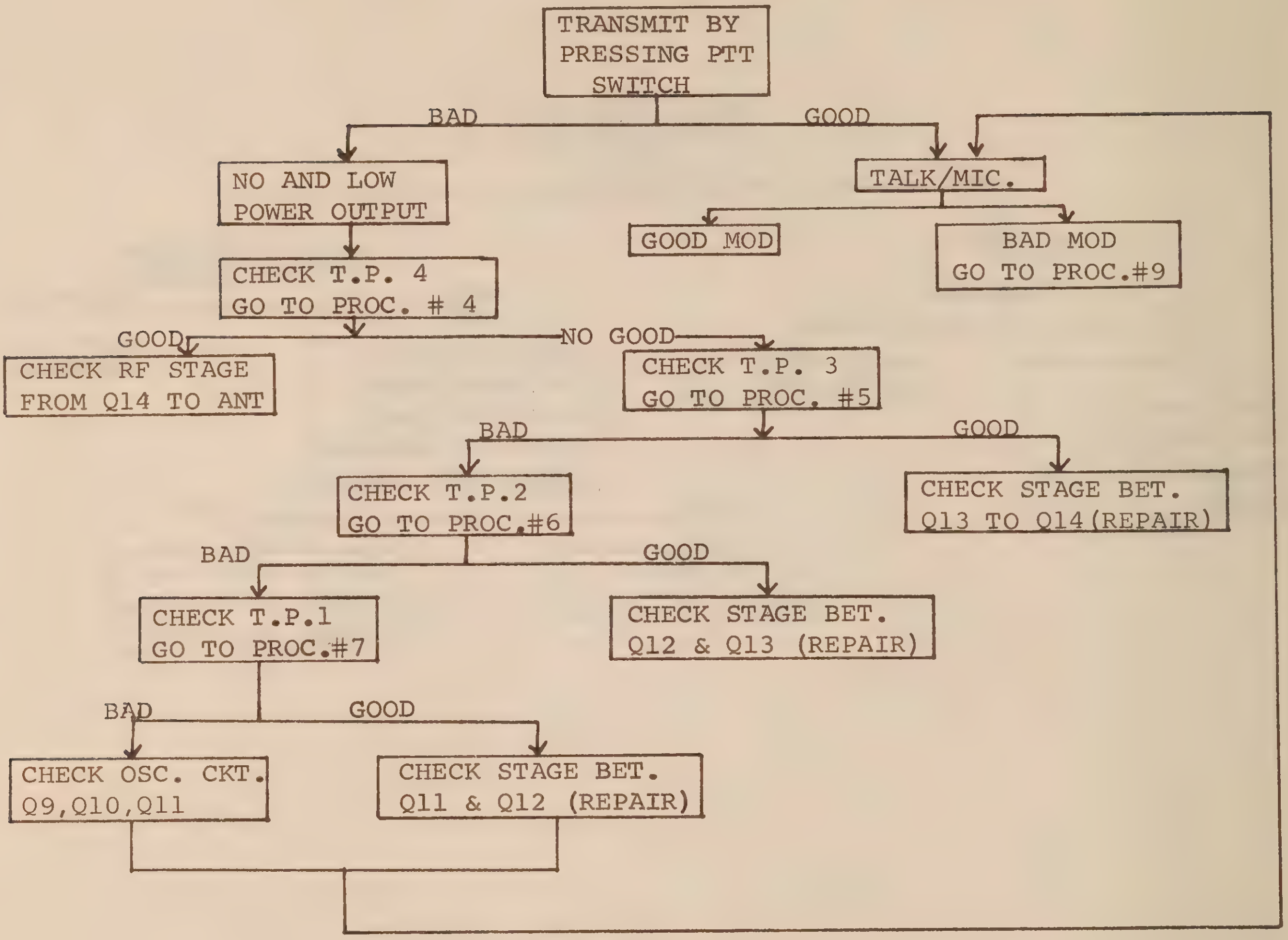
SERVICE BULLETINS

80-174(W)	MCH-40 Tx frequency stability due to voltage variations.
80-175(W)	MCU-30, 30II Transient frequency shift when Tx is keyed.
80-176(G)	MCH-40 PA Parts changes for improved quality.
80-177(W)	P1412 DC Power Supply Definition of circuit changes
80-178(W)	MA-116 Tone Board, P.C. Board 504-046 Rev. "C" only. Low Rx Sensitivity after Tx is keyed.
80-179(W)	BTH-201B W/MA-116, Board 504-046 Rev. "C" and later. No Encode tone when Tx is keyed.
80-180(G)	XLH-252 Self quieting spur frequencies
80-181(G)	XLH-252 Failure of synthesizer (IC511) during normal operation.
80-182(G)	XLH-252 Excessive low frequency deviation of carrier on transmit when radio is near Tx antenna.
80-183(W)	MCU, MCH, MCL Problems when using MA-127, 128, or 129
80-184(G)	XLH-252 Microprocessor failure due to static electricity in low humidity conditions.
80-185(G)	XLH-252 Prior to serial #2147 Transmitter problems when a supply line choke is used.
80-186(G)	XLH-252 Excessive Tx delay when supply line choke is used.
80-187(G)	MCH-40 Mechanical and Hardware Parts List
80-188(W)	P1412 Power Supply Definition of circuit changes

UHF TROUBLESHOOTING GUIDE

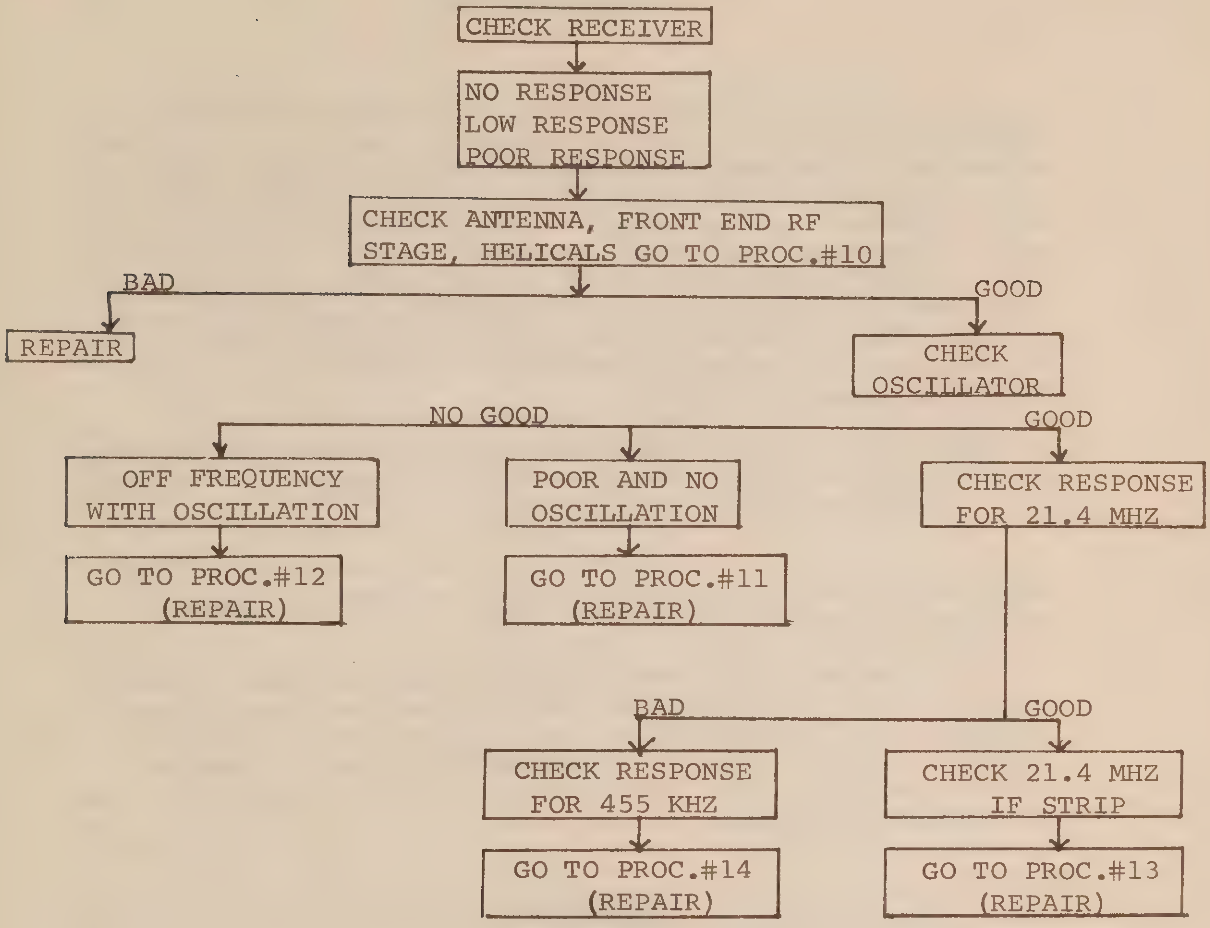

TURN UNIT ON
AUDIO
YES
NO
CHECK SQUELCH
CHECK SPEAKER
YES
NO
GOOD
NO GOOD
GO TO RECEIVER AND TRANSMITTER TROUBLESHOOTING CHART
GO TO PROC. #3
CHECK VOLTAGE ON POWER SUPPLY CIRCUIT PLEASE REFER TO VOLTAGE CHECK FOIL SIDE
REPAIR
GOOD
NO GOOD
GO TO PROC. #1 (IC 1 & IC 2)
GO TO PROC. #2 REFER TO VOLTAGE CHECK FOIL SIDE

UHF TRANSMITTER TROUBLESHOOTING CHART



TRANSMIT BY PRESSING PTT SWITCH
BAD
GOOD
NO AND LOW POWER OUTPUT
TALK/MIC.
GOOD MOD
BAD MOD GO TO PROC.#9
CHECK T.P. 4 GO TO PROC. # 4
GOOD
NO GOOD
CHECK RF STAGE FROM Q14 TO ANT
CHECK T.P. 3 GO TO PROC. #5
BAD
GOOD
CHECK T.P.2 GO TO PROC.#6
CHECK STAGE BET. Q13 TO Q14 (REPAIR)
BAD
GOOD
CHECK T.P.1 GO TO PROC.#7
CHECK STAGE BET. Q12 & Q13 (REPAIR)
BAD
GOOD
CHECK OSC. CKT. Q9,Q10,Q11
CHECK STAGE BET. Q11 & Q12 (REPAIR)

UHF RECEIVER TROUBLESHOOTING CHART


CHECK RECEIVER
NO RESPONSE
LOW RESPONSE
POOR RESPONSE
CHECK ANTENNA, FRONT END RF STAGE, HELICALS GO TO PROC.#10
BAD
GOOD
REPAIR
CHECK OSCILLATOR
NO GOOD
GOOD
OFF FREQUENCY WITH OSCILLATION
POOR AND NO OSCILLATION
CHECK RESPONSE FOR 21.4 MHZ
GO TO PROC.#12 (REPAIR)
GO TO PROC.#11 (REPAIR)
BAD
GOOD
CHECK RESPONSE FOR 455 KHZ
CHECK 21.4 MHZ IF STRIP
GO TO PROC.#14 (REPAIR)
GO TO PROC.#13 (REPAIR)

PROCEDURE 1.

NO AUDIO

A. Check the supply circuit base on UHF voltage reference and if found good, check volume control switch, adjusting clockwise give supply to the receiver stage and audio circuit. Check also the squelch control if it is at a minimum or off position. If the squelch control is set to maximum, the audio is totally dead, pin #13 of IC1 is zero voltage, squelch switch transistor Q4 and Q5 will not function also and no power to supply the audio section (IC2). Voltage check and resistance check are recommended for better detection on audio stage. Refer to UHF voltage reference.

B. Check the wiring from the input of audio section to volume control and from the volume control to the output of the receiver section (Speaker).

C. Check pin #9 of IC1 if it is shorted to ground, this causes no audio, although all voltage on the audio section is okay.

D. Inject 1KHz audio signal from audio generator at the input of IC2 pin #2 (LM386N), volume control and pin #9 of IC1 to make sure that all coupling components are okay. This procedure also helps to detect whether IC2 is good or bad by just looking at the signal waveform on the oscilloscope.

PROCEDURE 2.

POWER SUPPLY CIRCUIT (SEE UHF VOLTAGE REFERENCE)

RECEIVER SWITCHING TRANSISTOR

The output of Q8 is regulated at about 8 volts. When PTT is pressed to transmit the receiver switching transistor is grounded, turning off the entire receiver section.

NOTE: When checking any transistor (Q) always check for the possible hanging; defective components around it.

PROCEDURE 3.

WITH AUDIO BUT SQUELCH NOT FUNCTIONING

Check Pin #10 of IC1 if shorted to ground. Pin #3 of the same IC should be 1.8 volts approximately when the squelch control is off position, adjusting the squelch control clockwise, pin #13 of IC1 will be zero, meaning squelch switch of IC1 is functioning. Check resistor R16 (220K) this usually broken or open. Check resistor R14 (10K) might be shorted to resistor R15 (10K) at the diode foil or possibly broken.

Check switching transistor Q4 and Q5 it might be leaky that the audio circuit is always on. Check also the continuity of the black wire connected on pin #13 of IC1 to R30 which is connected to the base of Q5. If black wire is open or hanging, squelch switch will not function.

Perform continuity test on two conductor cable. Also check if any of the conductor is shorted to ground this affect the squelch and circuit.

PROCEDURE 4.

CHECK T.P. 4

Connect a voltmeter set for 0-2V range to TP4. Reading obtained should be approximately 1.5V ±30%. When obtained reading is low, adjust T16 and T17. If nothing happens go to TP3 for a check.

PROCEDURE 5.

If TP3 checks to be okay, problem lies between stage of Q13 and Q14. Check all bypass and coupling capacitor, transformer and two transistors. However, when low or no TP3 is observed proceed to TP2 for further troubleshooting.

PROCEDURE 6.

Measure TP2 using 0-2 volt range voltmeter. Reading should be near the value of voltage specified or the voltage reference. If reading obtained is normal, problem lies between Q12 and Q13 stage. Check both transistors, coupling capacitor, transformer and bypass capacitor on that stage. When TP2 does not exist go to TP1.

PROCEDURE 7.

Connect a voltmeter to TP1 set for 0-.5V range, tune T12 for a dip (Minimum), voltmeter reading should be approximately 0.3V. If no dip or voltage observed the oscillator circuit is dead. Check voltages of Q9, Q10, and Q11 referring to the voltage reference provided. If voltage is normal, check stage bet. Q11 and Q12, also check the transmit crystal or its connection on the radio (see if it is on the right channel)

PROCEDURE 8.

Connect a voltmeter to TP5 making sure that TP5 is properly adjusted. Tune TC9, TC10, T16, and T17 for maximum reading TP5 around 0.25V. If no or low reading is observed Q15 or any of the coupling capacitor is bad, it may also be R60 shorting to ground. But if reading reaches to about 0.4 volt or more, R60 is probably open. Verify these by using an ohmmeter across R60. If spectrum analyzer is readily available set it for 100 MHz/division. 3MHz resolution and the input attenuator to its proper level. With the PTT switch keyed, start tracing your signal at the collector of Q14 going back to the antenna. At the point where signal is lost or suffered a great loss the preceeding stage is at fault.

SPURIOUS EMISSION

Spurious omission is also one problem of the radio. If spectrum analyzer is available and the spurious emission is about 10 db below carrier, check voltage on D4, PTT is keyed it should have a reading of 0.8 volt, if voltage is high, D4 is probably open. Check D4 and R65 by resistance check. If no voltage attain D4 is probably shorted to ground or Tx supply for D4 is open. If voltage at D4 is okay, check base emitter resistance of Q17 for short.

If spurious emission is about 30 db below carrier, check TP5, if found low adjust T16 and R17, TC9, TC10. If TP5 is normal, check TC11, R62, and R86. If all the preceeding steps were made and spurious problem still remains, check Q14 and Q17 by resistance check.

PROCEDURE 9.

BAD MODULATION

Bad modulation can be checked by signal tracing using an oscilloscope and audio generator of 1 KHz/ 10MV peak to peak amplitude. Tracing starts from the microphone input to microphone amplifier, limiter, integrator buffer and filter. When the signal is lsot or becomes distorted, the problem lies on that stage. Refer to the foil side tracing points and the corresponding waveform pattern provided for this test.

PROCEDURE 10.

ANTENNA, FRONT END (HELICALS)

Using an RF probe with a 5PF capacitor in series, start injecting your (fo) operating frequency, from the antenna going to the base of Q2. This implies using signal injection method in isolating the bad stage in the RF section, with the aid of signal injection guide provided for. When passing through each component, no great loss in the signal strength should be suffered (not more than 10 db). If in case signal is lost after passing through each component the fault lies on that area where signal was lost. Measure the voltage supply for both Q1 and Q2 and perform resistance test to determine the bad component. Also watch for an abnormal tuning of the helical, this is an indication of a bad helical or the component arount it.

PROCEDURE 11.

OSCILLATOR

A. Poor And No Oscillation.

Connect a voltmeter to TP6 and receiver crystal on its proper channel and tune T9 for minimum deflection (dip) of the voltmeter approximately 2 volt. If the said reading is not reached, the oscillator is not working normally, look for open transformer, defective transistor and hanging components.

PROCEDURE 12.

OFF FREQUENCY WITH OSCILLATION

If reading of about 2 volts is available at TP6 and still no receiver response, adjust the frequency setting of the signal generator above or below carrier frequency using 1 KHz increment. This problem is often due to defective or hanging capacitor in the oscillator circuit and sometimes bad transistor on the same stage.

PROCEDURE 13.

21.4 MHz RESPONSE

Using a .01 uf probe inject 21.4 MHz signal at the base of Q2. If no signal is received or signal display is distorted, start injecting the 21.4 MHz signal at pin 16 of IC1 going back to Q2. If signal loss is significant or becomes distorted when passing through each component, a comparison can be made on reading obtained with the signal injection guide provided. Measure supply voltage at specified points and check resistance of components where the signal is lost.

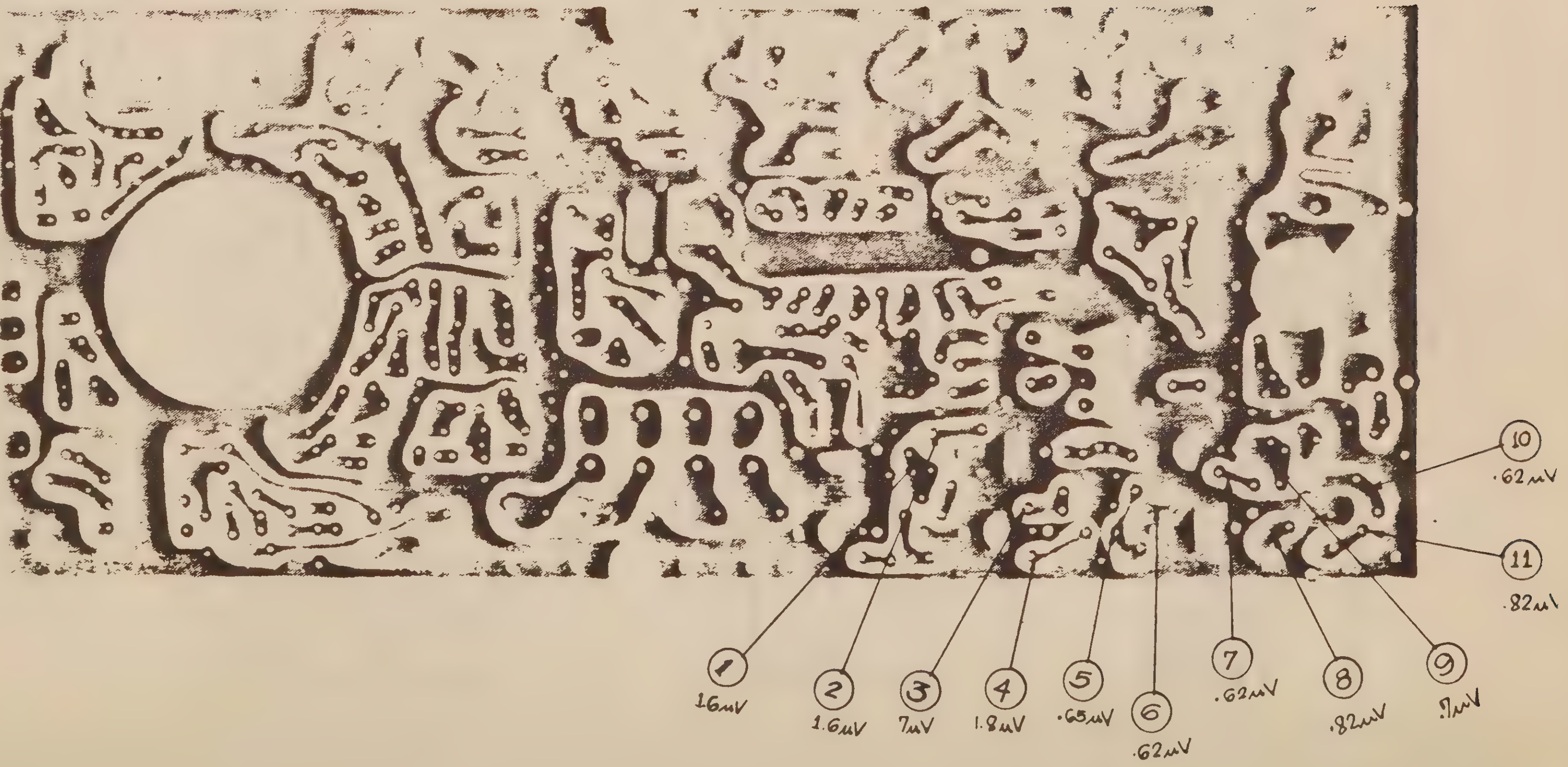
PROCEDURE 14.

455 KHZ RESPONSE

The same procedure like the above could be applied for these tests. Using 455 KHz signal injected at pin #3 to pin #1 of IC1. Reading should be near the value indicated of the signal injection guide. If signal at pin #1 is applied and no signal display appears on the scope, increase the FM signal generator output until the receiver produces a clean sinewave. If at this point there is still no response, try tapping a new 20.945 MHz crystal and observe if it cures the problem. Also, check for hanging components such as capacitors and resistors. When all the foregoing procedure has been made and still there is no response, the only suspicious component left is IC1.

	OPERATION DESCRIPTION UHF F0 REFERENCE SIGNAL INJECTION LEVEL	OPN. CODE:	PAGE :
Prepared By: Date :	Part No: | Rev. | Labor Code:	Description :	

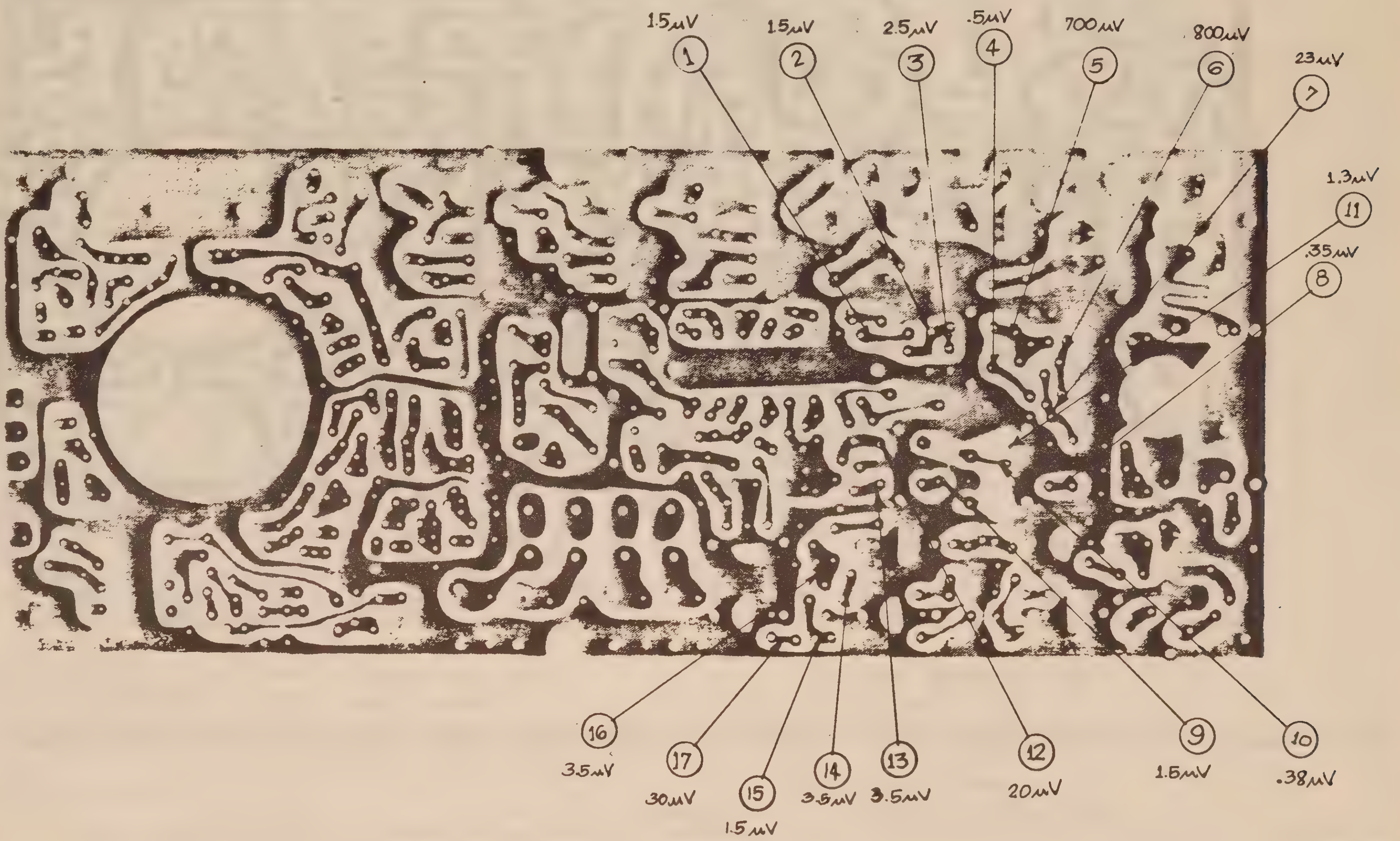
Readings were taken using 5pf test probe at 12 dB sinadder.



① 16µV
② 1.6µV
③ 7µV
④ 1.8µV
⑤ .65µV
⑥ .62µV
⑦ .62µV
⑧ .82µV
⑨ .7µV
⑩ .62µV
⑪ .82µV

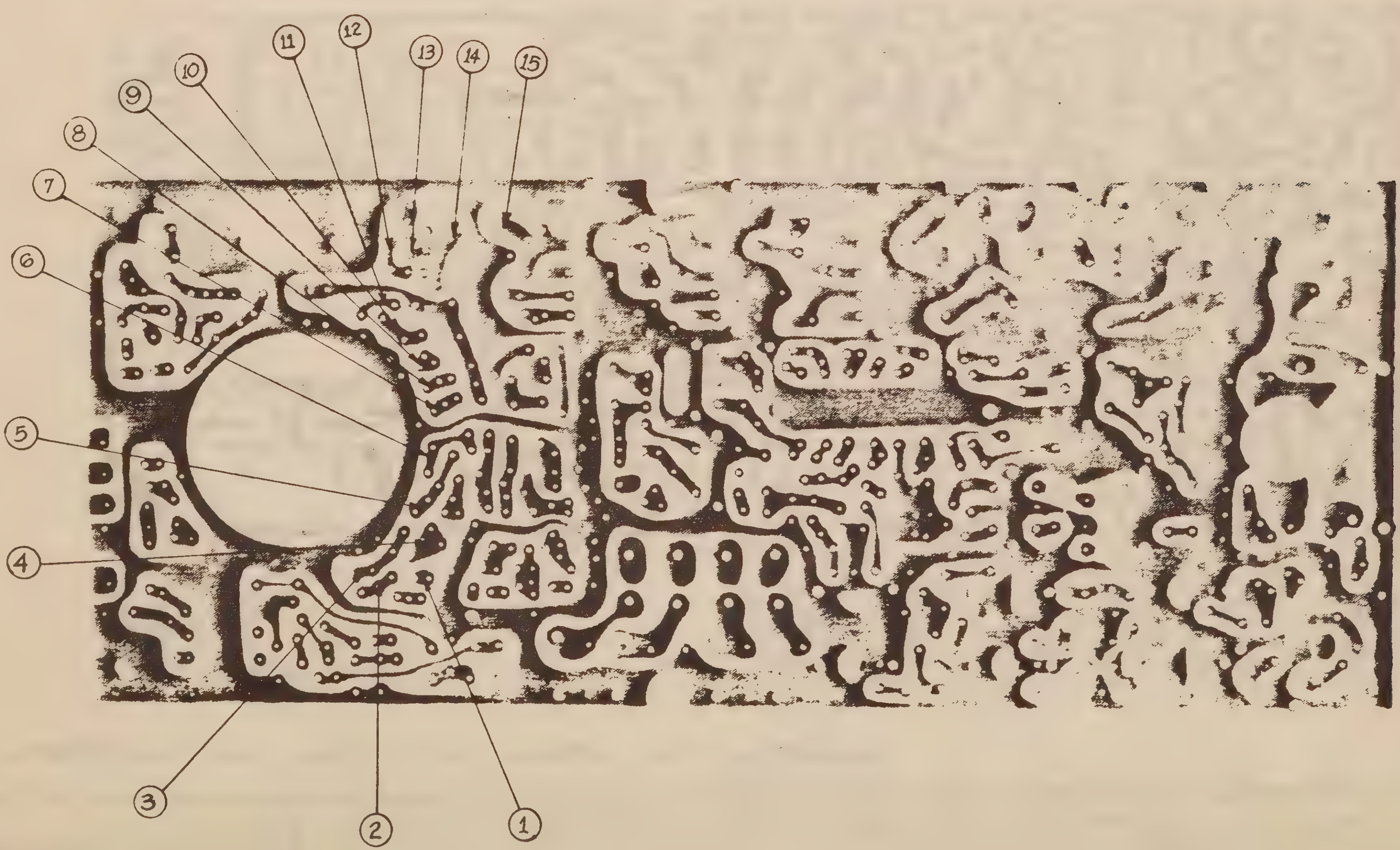
	OPERATION DESCRIPTION 21.4MHZ REFERENCE SIGNAL INJECTION LEVEL		P/N. CODE:	PAGE :
Prepared By: Date :	Part No:	Rev.	Labor Code:	Description :

Readings were taken using 0.01 µf test probe at 12 dB sinadder.



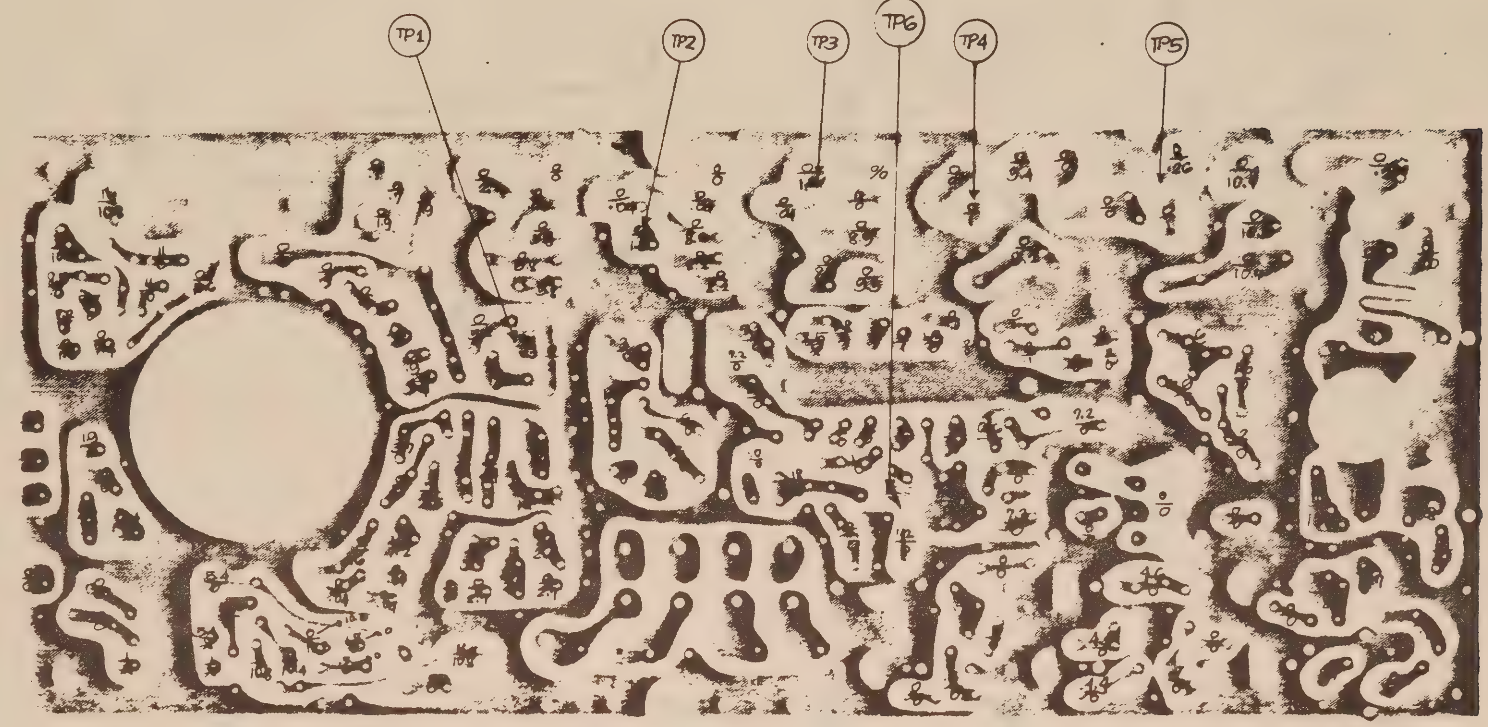
1.5µV
1
1.5µV
2
2.5µV
3
.5µV
4
700µV
5
.800µV
6
23µV
7
1.3µV
11
.35µV
8
16
3.5µV
17
30µV
15
1.5µV
14
3.5µV
13
3.5µV
12
20µV
9
1.5µV
10
.38µV

	OPERATION DESCRIPTION UHF MODULATION TEST POINTS		OPN. CODE:	PAGE :
Prepared By: Date :	Part No:	Rev.	Labor Code:	Description :


1
2
3
4
5
6
7
8
9
10
11
12
13
14
15

UHF FOIL SIDL VOLTAGE REFERENCE

Prepared By:	Part No:	Rev.	Labor Code :	Description :
ate :				



* INDICATES DC VOLTAGE TENDS TO DECREASES SLOWLY

→ INDICATES VOLTAGE TO CHANGE DURING SQUELCH

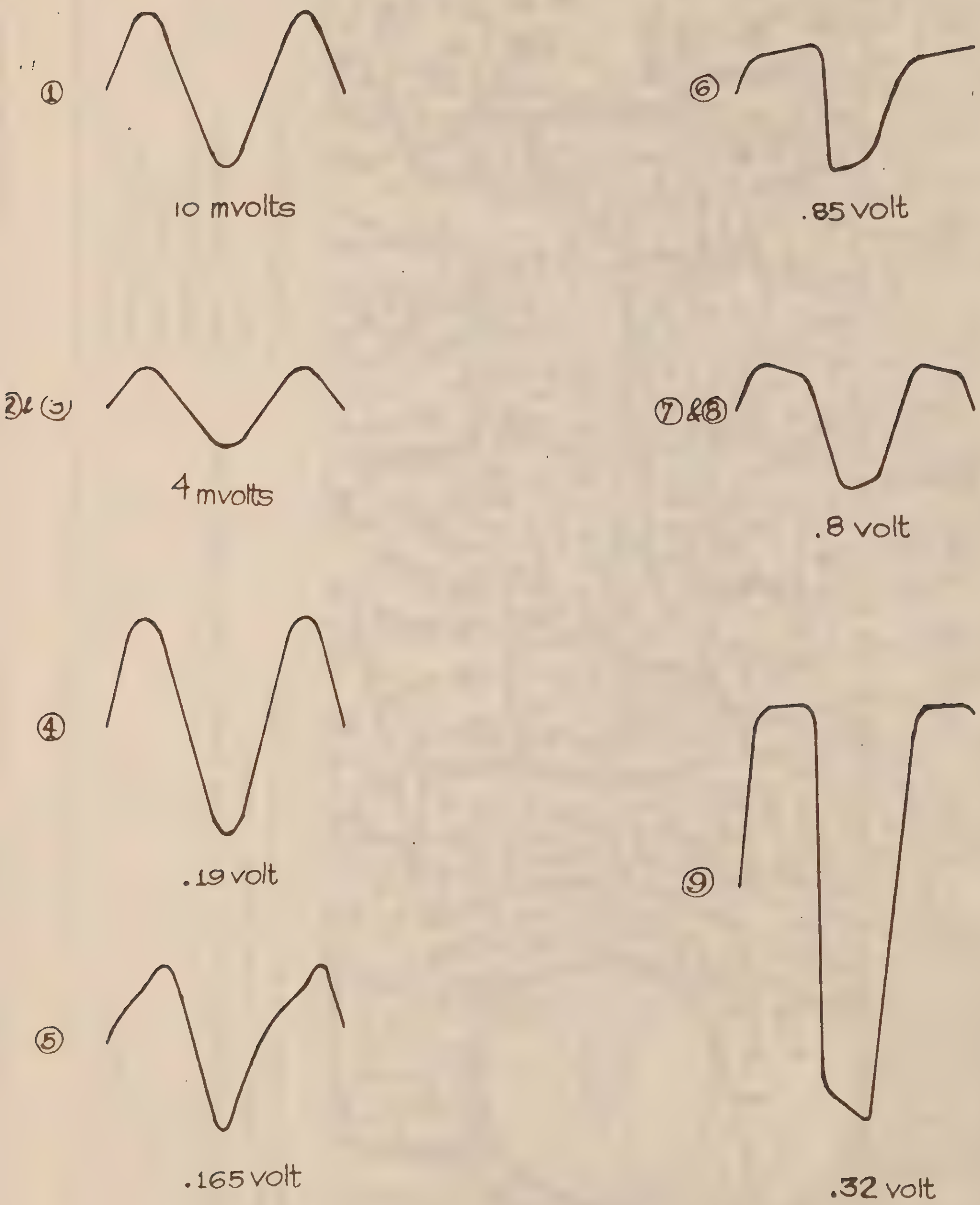
VOLTAGES WERE OBTAINED ON 10 UHF GOOD RADIOS WITH CRYSTAL (AVE.)

$\frac{RX}{TX}$

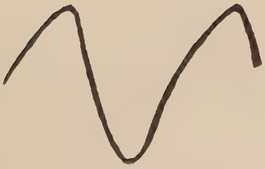
TEST EQUIPMENT USE:

1. VTVM
   HEATH SCHLUMBERGER
   MODEL SM 5228
2. POWER SUPPLY
   applying 11 volts DC
   after D12.

UHF MODULATOR SIGNAL WAVEFORM

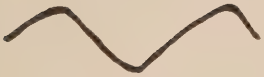

①
10 mvolts
⑥
.85 volt
②&③
4 mvolts
⑦&⑧
.8 volt
④
.19 volt
⑨
⑤
.165 volt
.32 volt

⑩



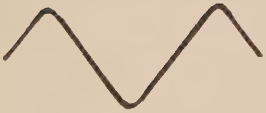
.46 volt

⑪ & ⑫



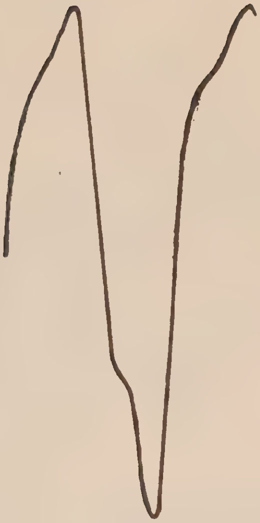
35 mvolts

⑬



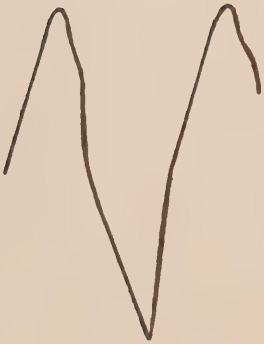
.45 volt

⑭



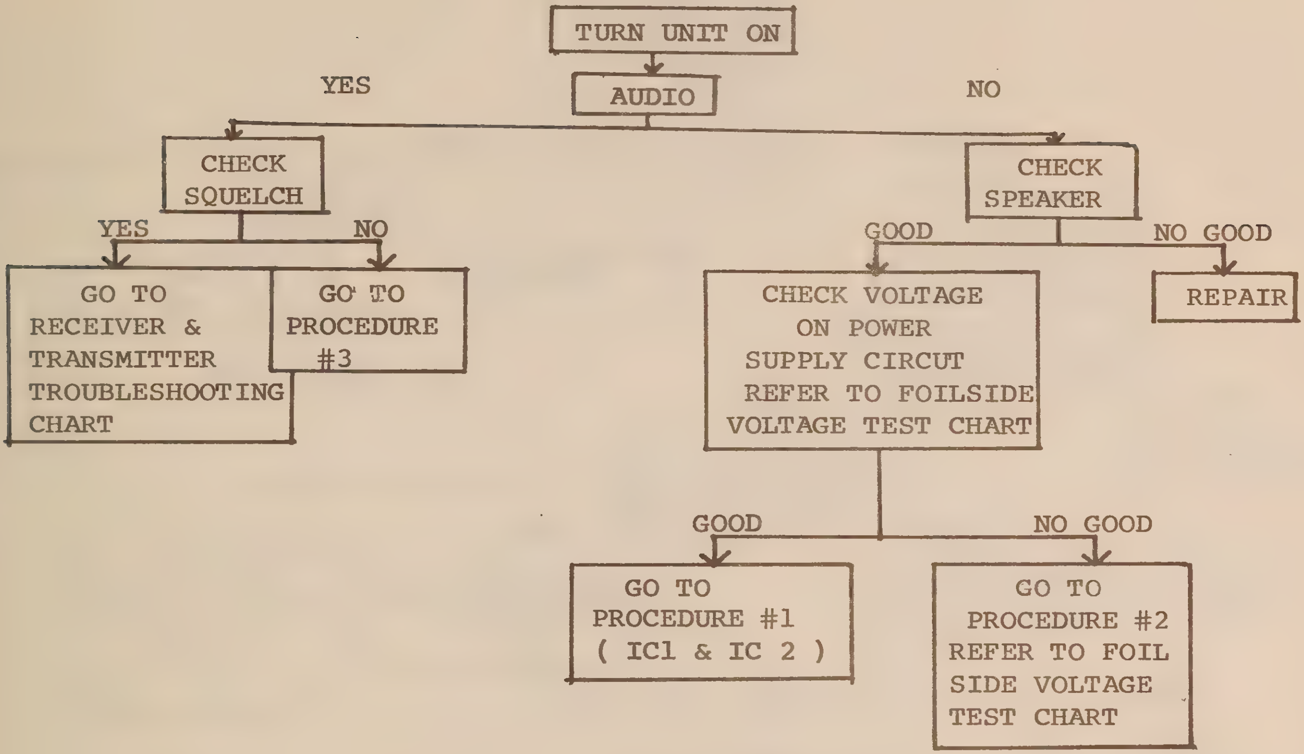
35 mvolts

⑮

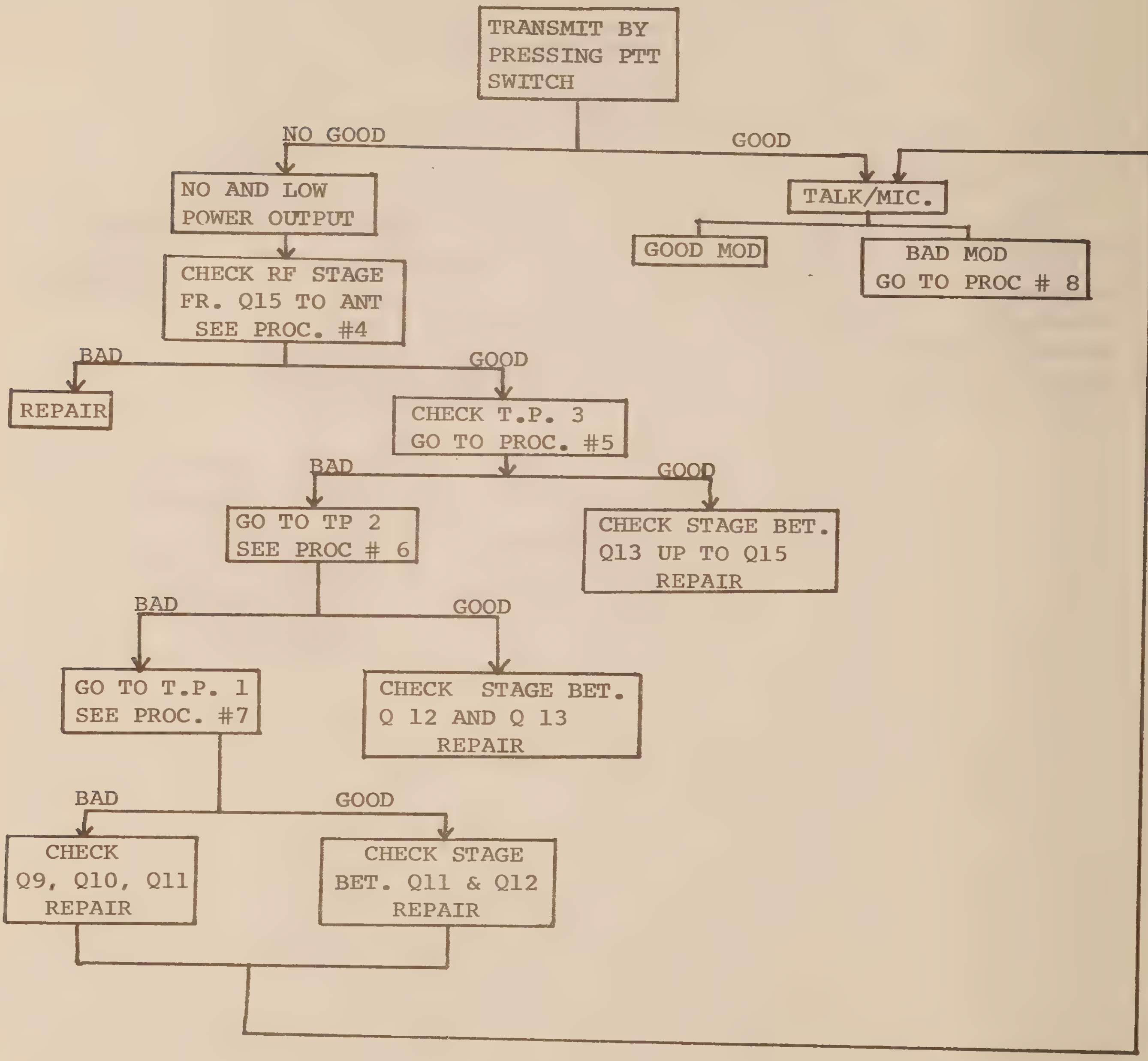


25 mvolts

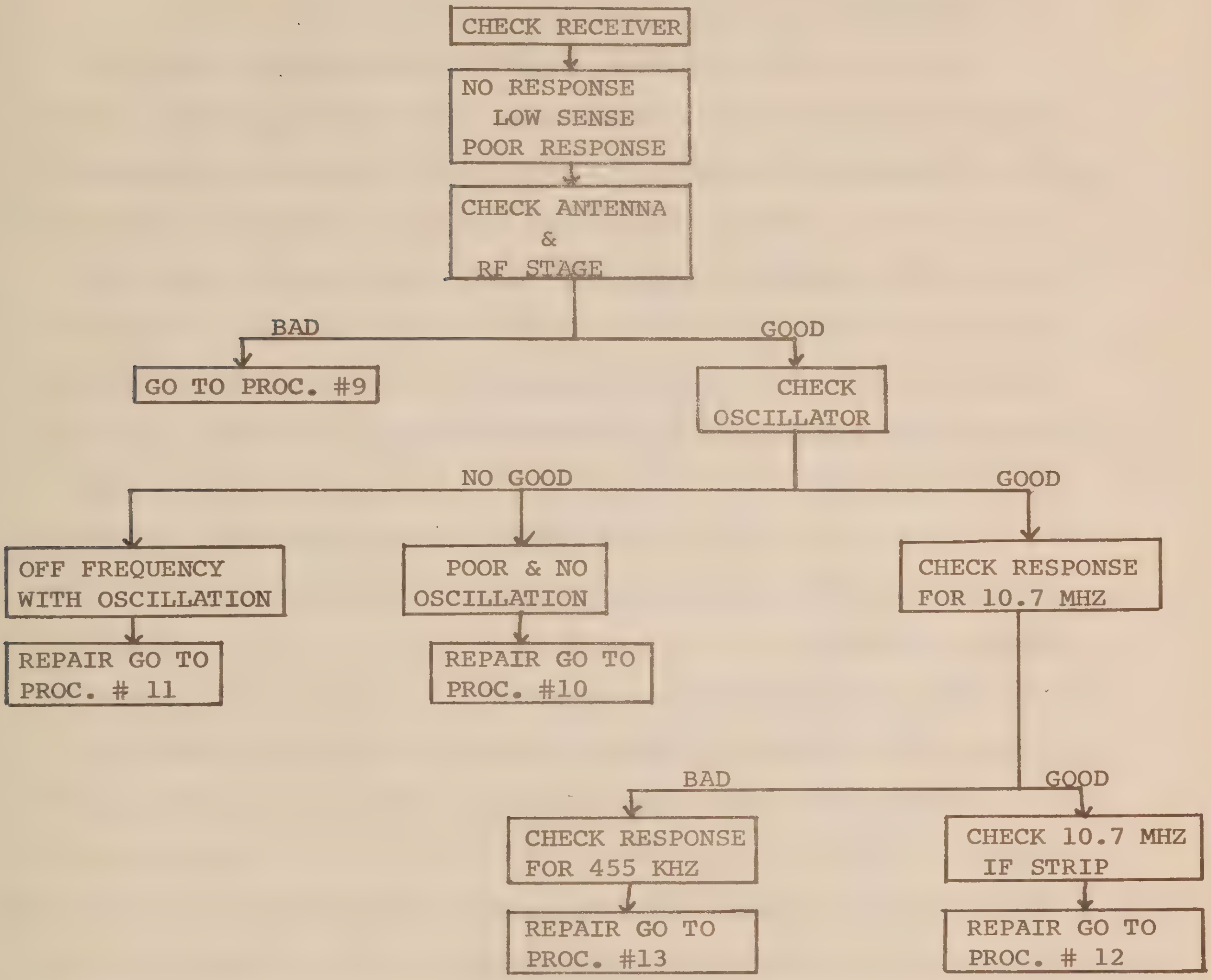
VHF TROUBLESHOOTING GUIDE


TURN UNIT ON
AUDIO
YES
NO
CHECK SQUELCH
YES
NO
GO TO RECEIVER & TRANSMITTER TROUBLESHOOTING CHART
GO TO PROCEDURE #3
CHECK SPEAKER
GOOD
NO GOOD
CHECK VOLTAGE ON POWER SUPPLY CIRCUT REFER TO FOILSIDE VOLTAGE TEST CHART
REPAIR
GOOD
NO GOOD
GO TO PROCEDURE #1 (IC1 & IC 2)
GO TO PROCEDURE #2 REFER TO FOIL SIDE VOLTAGE TEST CHART

VHF TRANSMITTER TROUBLESHOOTING CHART


TRANSMIT BY PRESSING PTT SWITCH
NO GOOD
GOOD
NO AND LOW POWER OUTPUT
TALK/MIC.
GOOD MOD
BAD MOD GO TO PROC # 8
CHECK RF STAGE FR. Q15 TO ANT SEE PROC. #4
BAD
GOOD
REPAIR
CHECK T.P. 3 GO TO PROC. #5
BAD
GOOD
GO TO TP 2 SEE PROC # 6
CHECK STAGE BET. Q13 UP TO Q15 REPAIR
BAD
GOOD
GO TO T.P. 1 SEE PROC. #7
CHECK STAGE BET. Q 12 AND Q 13 REPAIR
BAD
GOOD
CHECK Q9, Q10, Q11 REPAIR
CHECK STAGE BET. Q11 & Q12 REPAIR

VHF RECEIVER TROUBLESHOOTING CHART


CHECK RECEIVER
NO RESPONSE LOW SENSE POOR RESPONSE
CHECK ANTENNA & RF STAGE
BAD
GOOD
GO TO PROC. #9
CHECK OSCILLATOR
NO GOOD
GOOD
OFF FREQUENCY WITH OSCILLATION
POOR & NO OSCILLATION
CHECK RESPONSE FOR 10.7 MHZ
REPAIR GO TO PROC. # 11
REPAIR GO TO PROC. #10
BAD
GOOD
CHECK RESPONSE FOR 455 KHZ
CHECK 10.7 MHZ IF STRIP
REPAIR GO TO PROC. #13
REPAIR GO TO PROC. # 12

PROCEDURE 1.

NO AUDIO

a. After checking the power supply circuit on foil side voltage check and found it good, check volume control switch, adjusting clockwise give supply to the receiver stage and audio circuit. Check also the squelch control if it is at a minimum or off position. Of the squelch control is set to maximum, the audio is totally dead, pin #13 of IC1 is zero voltage, squelch transistor Q7 and Q8 will not function also and no power to supply the audio section (no receive) (IC2) voltage check and resistance check are recommended for better detection. See foil side voltage check.

b. Check the wiring from the input of audio section to volume control and from the volume control to the output of the receiver section (speaker)

c. Check pin #9 Of IC1 if is shorted to ground, this causes no audio, although all voltage on the audio section is okay.

d. Inject 1KHZ audio signal from sudio gen. at the input of IC2 pin #2 (LM386N), volume control and pin 9 of IC1 to make sure that all coupling component are okay. This procedure also help to detect whether IC2 is good or bad, just looking at the signal wave form on the oscilloscope.

PROCEDURE 2

POWER SUPPLY CIRCUIT: (See foil side voltage check)

RECEIVER SWITCHING TRANSISTOR

The output of Q6 is regulated at about 8 volts. When PTT is pressed to transmit, the receiver switching transistor is grounded, turning off the entire receiver section.

Q19 which is the transmitter switching transistor turns on and supplies voltage to all transmitter stages. This includes the deviation circuit, the multiplier and driver of the transmitter circuit. B^+ is always present at the final transistor, regardless of the mode of the radio.

A. RADIO ALWAYS ON TRANSMIT MODE

We can easily determine if the radio is on the transmit mode, the LED always lights on, check the PTT switch if it is defective, check components around PTT, sometimes it touches to terminal of the PTT switch that causes the radio to be on transmit mode. Pin #2 and pin #3 of the female jack (J3) might be shorted.

B. LED never lights ON although the transmitter switching transistor is good. Check the zener diode (D9) connected from the collector of the tx transistor, check also the resistor connected to the zener diode.

C. Defective Transmitter switching transistor (Q19)

If some parts of the transmitter stage become shorted to ground, especially the B+ the transmitter switching transistor in the first one to be affected, this transistor acts like a fuse, if any high current or overload due to shorted B+, the transmitter switching transistor will burn-out or it become leaky, this also affect the receiver section. The receiver switching transistor

CONT. OF PROCEDURE 2

(Q6) will disable the audio amplifier and cause no received.

CONSULT THE PCN FOIL SIDE FOR VOLTAGE CHECK

Note: When checking any Q(transistor) always check for the possible hanging, defective components around it.

PROCEDURE 3

WITH AUDIO BUT SQUELCH NOT FUNCTIONING

Check PIN No. 10 of IC1 if shorted to ground, pin #13 should be 1.8 volts approximately when the squelch control is at off position, adjusting the squelch control clockwise, PIN #3 of IC1 will be zero, meaning squelch switch of the IC1 is functioning. Check resistor R12, this is usually broken or open. Check resistor R10 (10K) might be shorted to resistor R11 (10K) at the diode foil or possibly broken.

Check switching transistor Q7 and Q8 it might be leaky that the audio circuit is always on. Check also the continuity of the black wire connected on pin #13 of IC1 to R20 which is connected to the base of Q7. Of black wire is open or hanging squelch switch will not function.

Perform continuity test on two conductor cable. Also check if any of two conductor is shorted to ground this affect the squelch and audio circuit.

R9 (220K) also affect the squelch circuit perform resistance check, check if it is shorted to ground.

PROCEDURE 4.

NO AND LOW POWER OUTPUT

By tuning TC13, the current reading should increase to 500MA or more and power should be indicated on the wattmeter. If no power is observed the problem lies on the circuitry following Q15. Check for short or defective capacitor. From collector of Q15 all the way up to antenna.

If tuning TC13, the current does not increase, checked the supply voltage of Q15 and Q14. In addition performed resistance check for the two transistor repectively for possible short or open.

PROCEDURE 5.

If both transistor check good, connect a voltmeter at T.P.3, a reading of about 1.5 volt should be obtained, if not check Q13, coupling; by-pass capacitor; T15 and T16 by ohmmeter.

Note: It would be best if capacitor or transistor under suspect will be directly substituted.

PROCEDURE 6.

Measure T.P. 2 using 0-2volt range voltmeter, reading should be about 1.5 volt, if voltage does not exist check Q12, T13 and T14 and components in the vicinity.

PROCEDURE 7.

Check oscillator (TP1), connect a volmeter to TP1 and shunt Transmitter crystal momentarily or channel. If the voltage decreases the oscillator is working normally. When TP1 makes no variation, check B+ supply along D8 and the rest of the transistors in the oscillator circuit, refer to coltage measurement indicated on Foil Side Diagram. If a difference in reading is observed, the components within that area is on suspect.

PROCEDURE8.

BAD MODULATION:

Bad modulation can be check by signal tracing using an oscilloscope and audio generator of 1 KHZ/10MV peak to peak amplitude. From microphone input, mic amplifier, limiter, integrator buffer and filter. When the signal is lost or become distorted, the problem lies on that stage. Refer to the foil side tracing points and waveform pattern provided for this test.

PROCEDURE 9.

BAD RF STAGE

Check antenna for short and open test. Using a 0.01uf RF probe, inject the crystal frequency starting at the base of Q2 following the signal path to the antenna. Signal attenuation should not be more than 10db when going thru each components. At the points where the signal is lost conduct voltage and resistance check.

PROCEDURE 10.
OSCILLATOR

A. POOR AND NO OSCILLATION

Connect a voltmeter to TP6 and receiver crystal on its proper channel and tune T9 for minimum deflection of the voltmeter approx. 1volt. If the said reading is not reached the oscillator is not working normally, look for open transformer, defective transistor and hanging components.

PROCEDURE 11.

OFF FREQUENCY WITH OSCILLATION

If reading of about 1 volt is available at T.P4 and still to receiver response, adjust the frequency setting of the signal generator above or below carrier frequency using 1KHZ increment. This problem is often due defective or hanging capacitor in the oscillator circuit and sometimes bad transistor.

PROCEDURE 12.

10.7MHZ RESPONSE

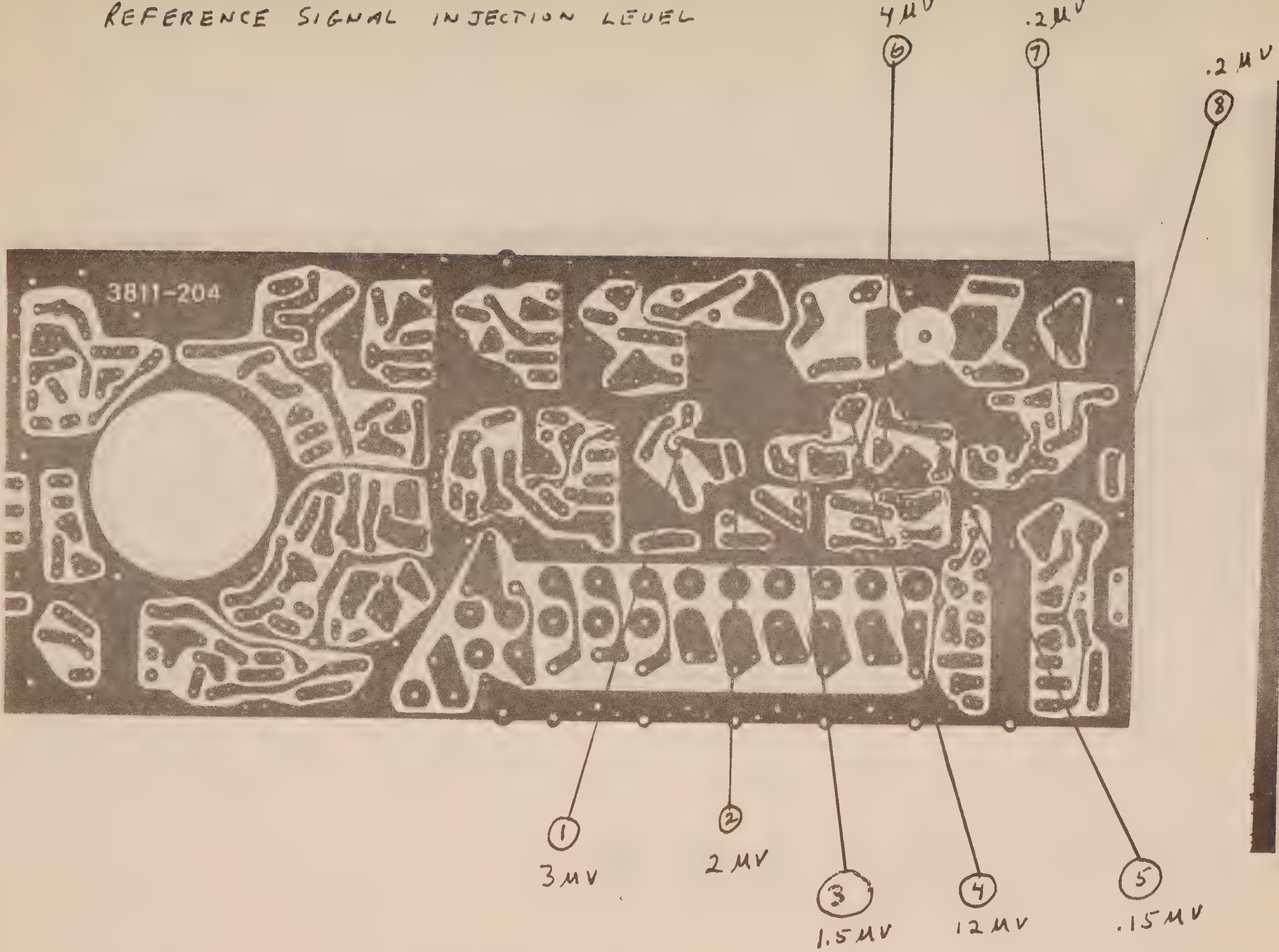
Using a .01 uf probe inject 10.7 signal at the base of Q2. If no signal is received or signal is distorted. Start injecting the 10.7 MHZ signal at pin 16 of IC1 going back to Q2. Refer to the 10.7 MHZ signal injection level for signal tracing. If signal loss is significant or becomes distorted when passing through each component, measure supply voltage at specified points; check resistance of component where the signal is lost.

PROCEDURE 13.

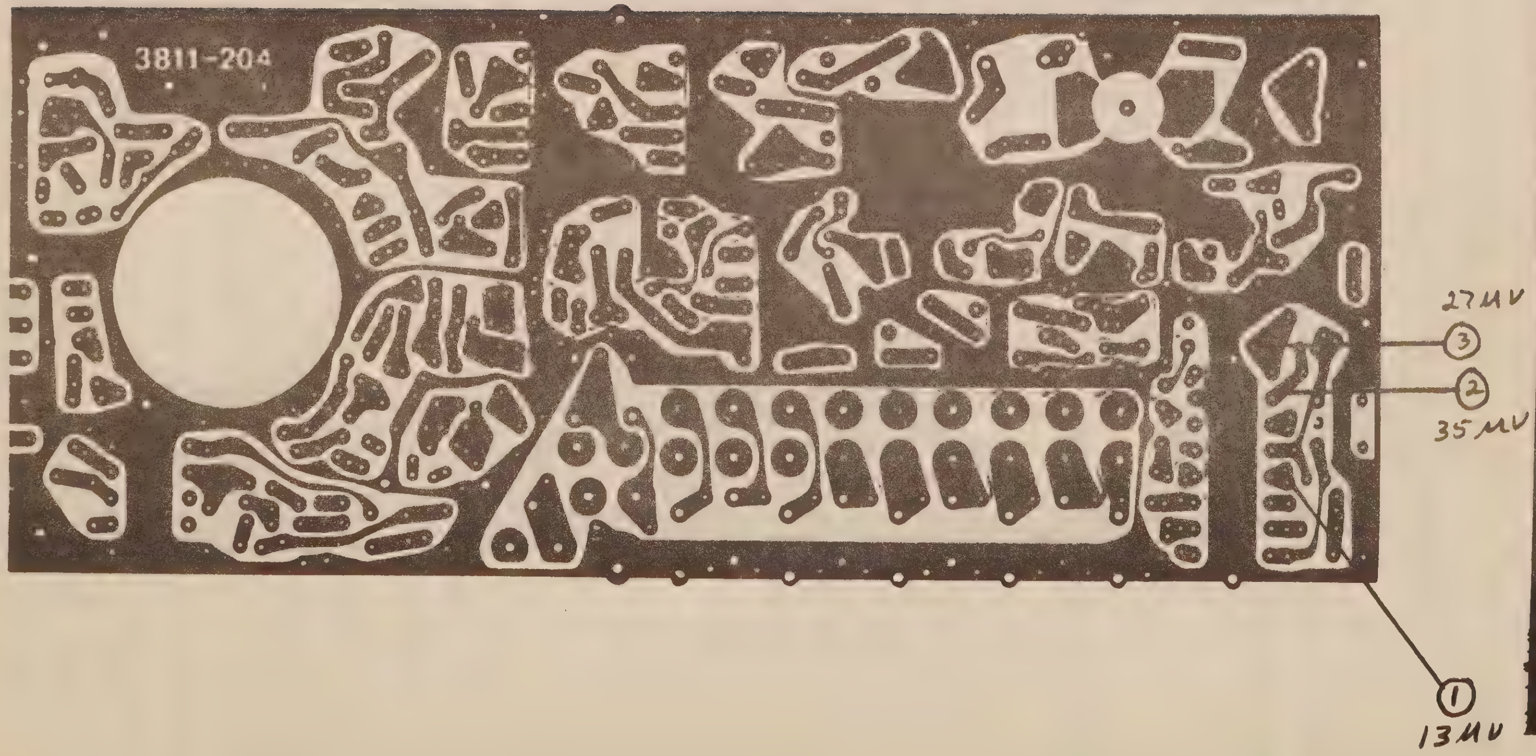
455KHZ RESPONSE

The same procedure like the above could be applied for these using 455KHZ signal starting at pin #3 to pin #1 of IC1. A reference signal injection level is provided appear on the scope. Increase the FM signal generator output till the receiver prodeces a lean sinewave. If at this point there is still no response. Try tapping a new 10.245MHZ crystal and observed if it cures the problem. Also check for hanging component such as capacitors. When all the foregoing procedure has been made and still there is no response. The only suspicious component left is IC1.

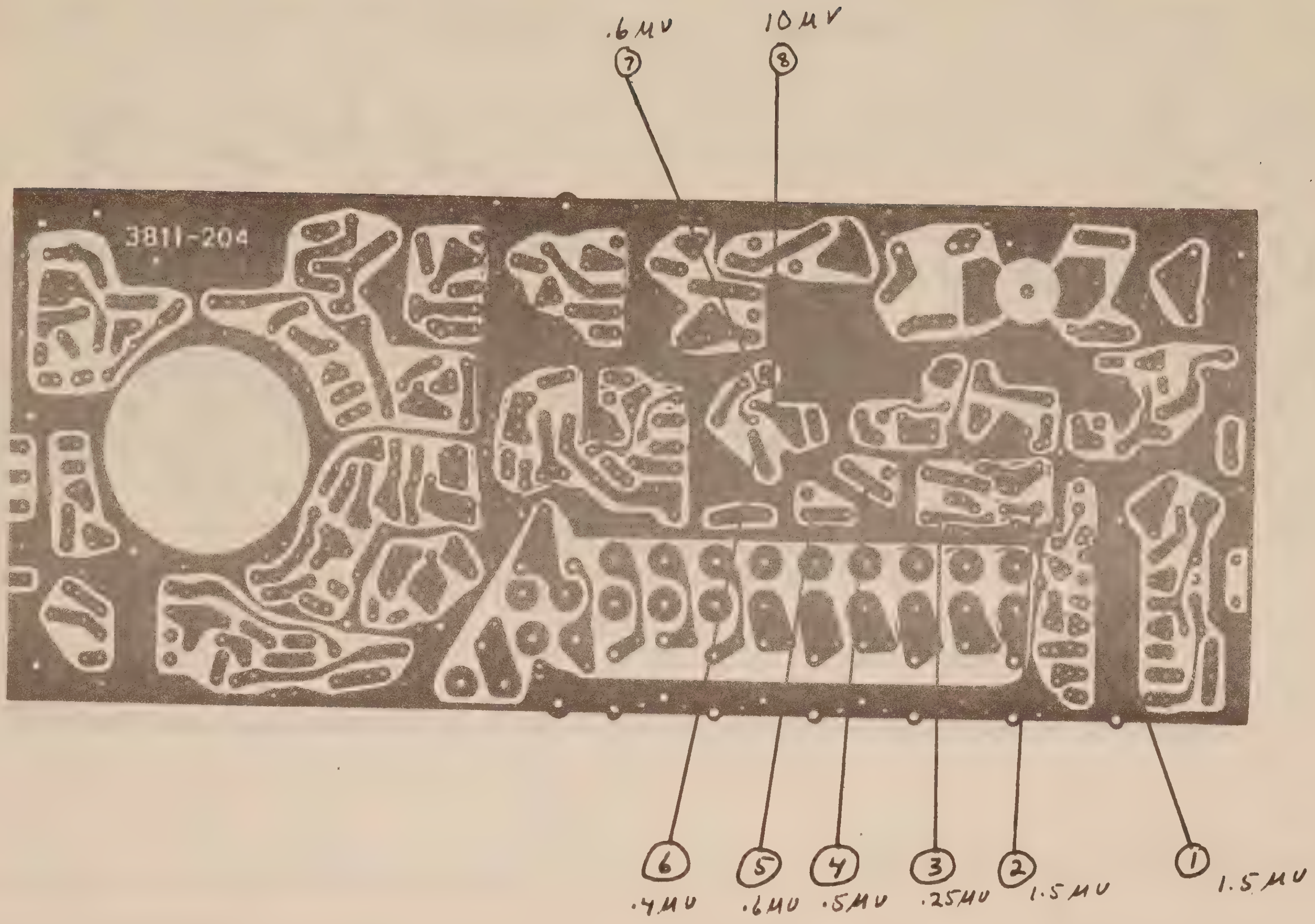
REFERENCE SIGNAL INJECTION LEVEL


3811-204
⑥ 4μV
⑦ .2μV
⑧ .2μV
① 3μV
② 2μV
③ 1.5μV
④ 12μV
⑤ .15μV

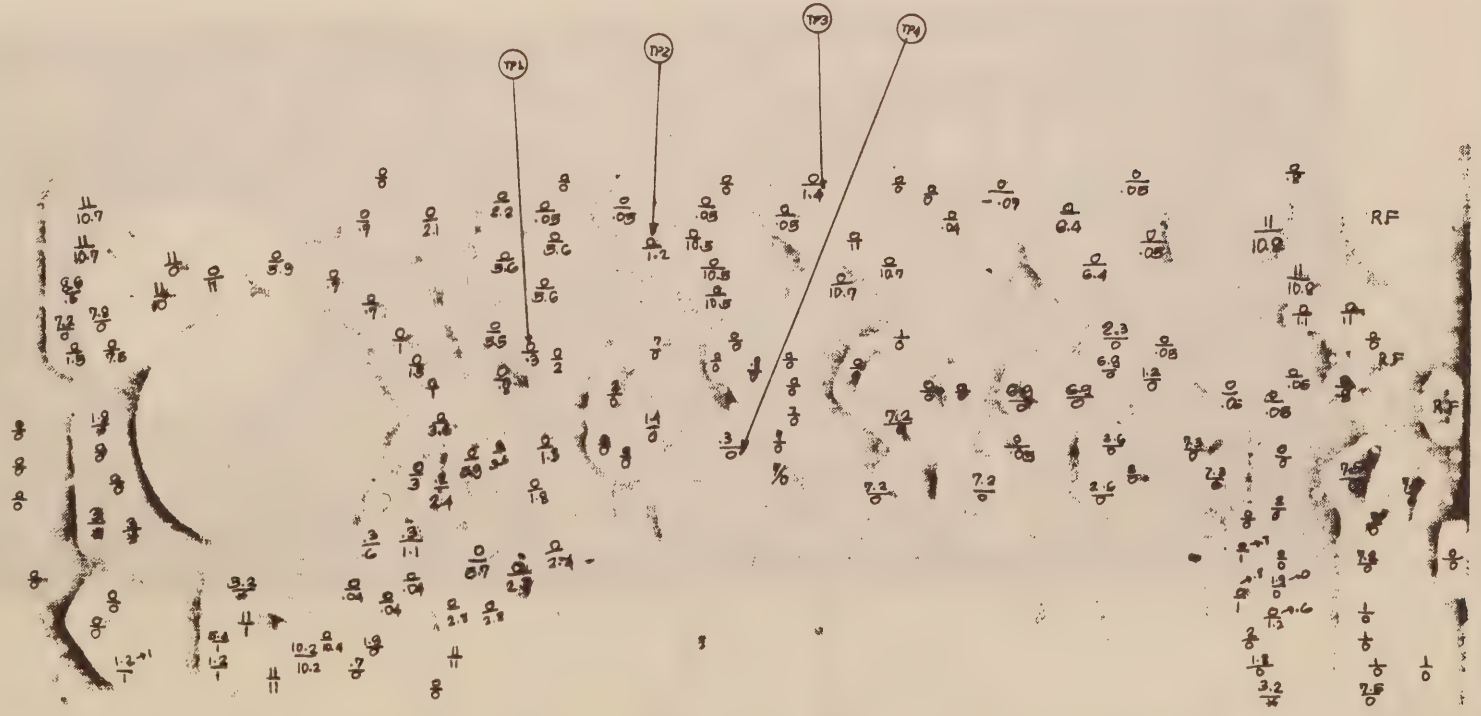
455 KHZ SIGNAL INJECTION LEVEL


3811-204
27MV
③
②
35MV
①
13MV

10.7 MHZ SIGNAL INJECTION LEVEL


.6MV
⑦
10MV
⑧
3811-204
⑥
.4MV
⑤
.6MV
④
.5MV
③
.25MV
②
1.5MV
①
1.5MV

	OPERATION DESCRIPTION VHF FOIL SIDE VOLTAGE REFERENCE	OPTN. CODE:	PAGE:
Prepared By: Date:	Part No: Labor Code:	Description:	



* INDICATES DC VOLTAGE TENDS TO DECREASES SLOWLY TO ZERO VOLTS

→ INDICATES VOLTAGE CHANGE DURING SQUELCH.

VOLTAGES WERE OBTAINED ON 10 VHF GOOD RADIOS WITH CRYSTAL (AVE.)

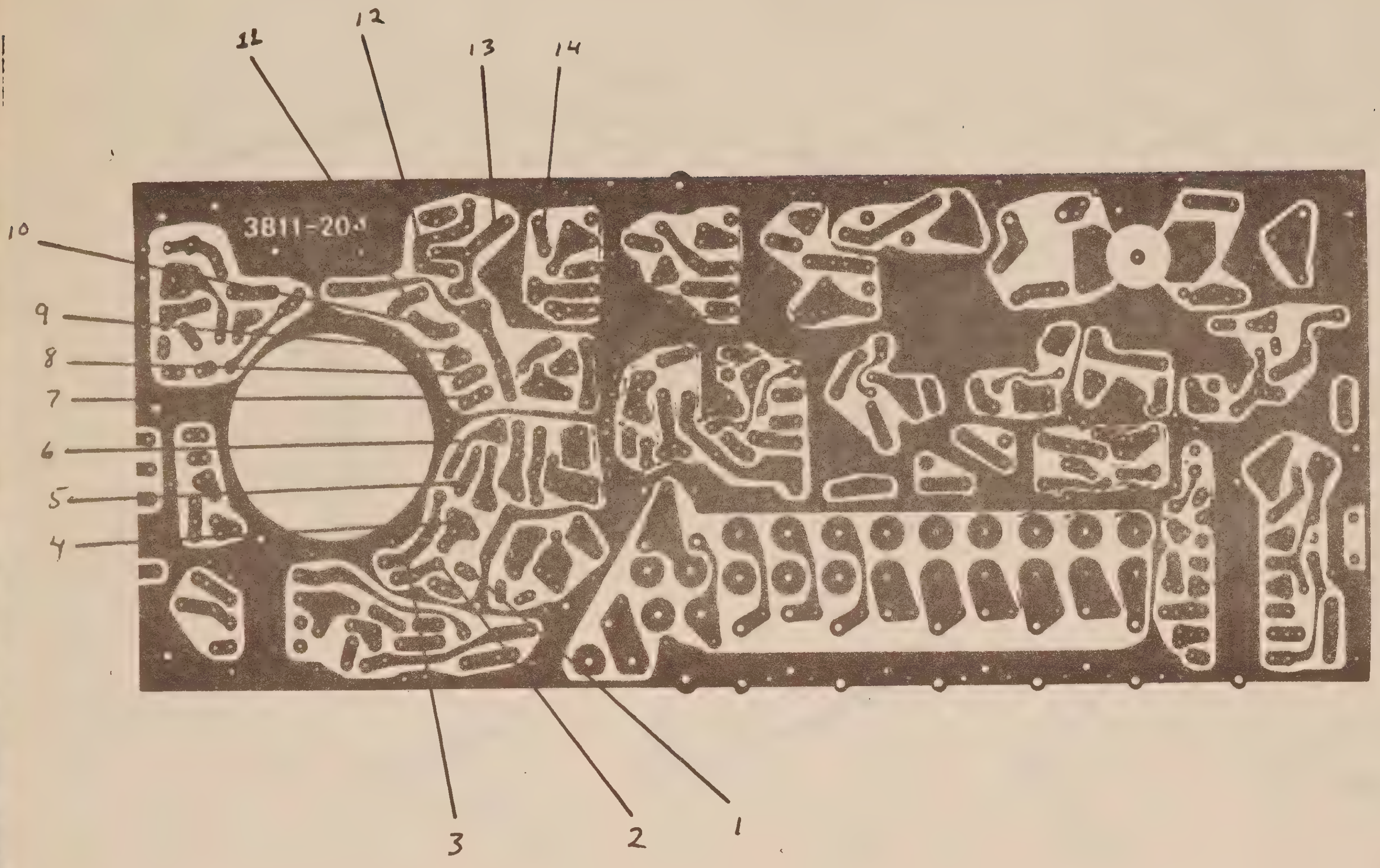
$\frac{RX}{TX}$

TEST EQUIPMENT USE:

① VTVM
HEATH SCHLUMBERGER
MODEL SM 5228

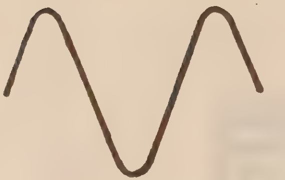
② POWER SUPPLY applying 11 volts
DC after D12

VHF MODULATION TEST POINTS


3811-204
1
2
3
4
5
6
7
8
9
10
11
12
13
14

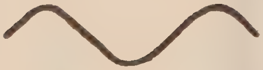
VHF MODULATOR SIGNAL WAVEFORM

① x1



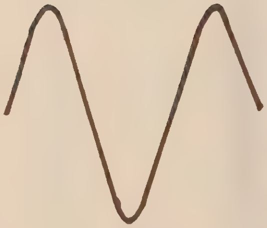
10mV

② & ③



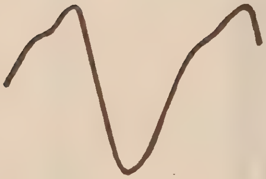
4mV

④ x10



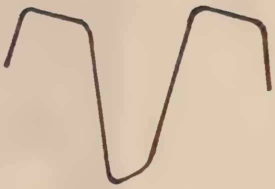
.16 volt

⑤



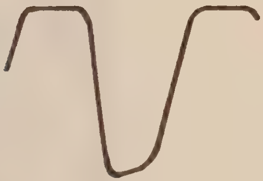
.1 volt

⑥ x11



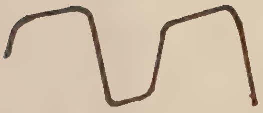
1 volt

⑦



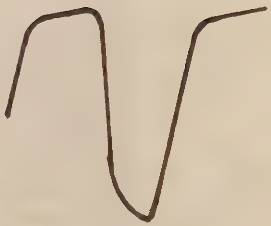
1 volt

⑧



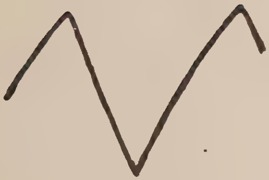
.7 volt

⑨



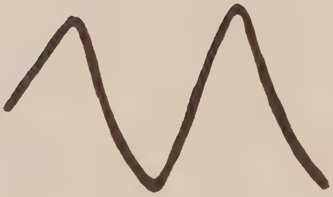
.37 volt

⑩



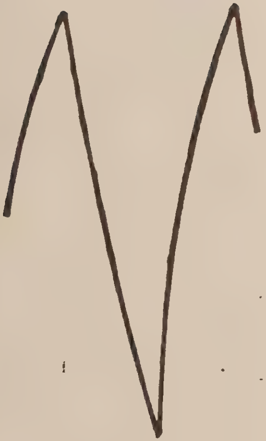
.1 VOLT

⑭



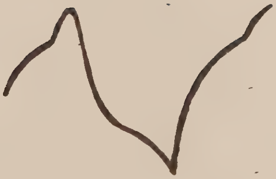
.06 VOLT

⑪ & ⑫



36 mVolt

⑬



.11 volt

Regency® Communications, Inc.
1227 S. Patrick Dr., Satellite Beach, FL 32937

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"REPRINTED COURTESY OF COMMUNICATIONS MAGAZINE" – FEBRUARY 1977

2-Way Technical Refresher Course

What To Do When You're Up to Your Ears in "Intermod"

A two-to-one spacing relationship of interfering signals is almost always the case in real life intermodulation situations. A three-to-two relationship or a four-to-three relationship can also result in "intermod." *Communications's* editorial adviser suggests some cures for these pesky problems.

Engineering Dept.
Regency Communications, Inc.
Satellite Beach, Florida

The need to have several base and repeater stations share a single site gives rise to a host of interference problems. The "landlords" at a number of common transmitter sites spend a great deal of time and energy in beating down these various interference problems, most of which come under "intermodulation interference."

Intermodulation interference is now common enough that almost all land mobile techs know its symptoms.

This article is intended to give some of the basic mathematical relationships that can be used in tracing and curing intermodulation problems.

By far the most common intermod problem is the one called "third order" intermod. It is caused when two very strong signals bearing a certain frequency relationship to each other and to the wanted signal show up at the antenna input of the receiver.

A numerical example of an intermod problem is the quickest way of demonstrating the basic relationships involved. Let's suppose that our receiver is tuned to receive on 454.500 MHz. Assume that there are two very strong signals also present at the antenna. One of the signals is at 454.700 MHz, and one of them is at 454.600 MHz. When these signals get into the receiver, and encounter a non-linear component, additional frequencies are created. These additional frequencies can include the various harmonics of the original signals, and can also include mixing combinations (sums and differences of the frequencies and their harmonics). In the typical third order intermodulation example given, the second harmonic of 454.600 MHz is created; this mixes with the 454.700 MHz signal to create a new signal, 454.500 MHz, as follows:

2nd harmonic of 454.600:	909.200 MHz
	– 454.700 MHz
	454.500 MHz

This 454.500 MHz signal "looks" just like a signal on the wanted channel of 454.500 MHz, and it goes through the selectivity circuits of the receiver, just like the wanted signals.

The above exercise dealt with interfering signals located above the frequency of the wanted channel. Similar results can occur from signals located and properly spaced below the wanted channel frequency. Let's consider the case of strong signals at 454.400 MHz and 454.300 MHz:

2nd harmonic of 454.400	908.800 MHz
Subtract 454.300	– 454.300 MHz
	454.500 MHz

Again, we have a resultant right on the channel frequency.

All of the above math has assumed that the creation of the intermodulation resultant occurred in the receiver

"CAR IS GO TO...
SQWAK
SQRAK!
SCREECH!!
BURGLARY IN PRO...

before the incoming signals had been converted to intermediate frequencies in the receiver. However, in older design receivers, the intermodulation could occur at the receivers high IF, or even at the low IF. Consider the case of a receiver with a 10.700 MHz IF system. The 454.500 wanted channel signal would be converted to 10.700 MHz in the receiver's first converter. The 454.700 MHz and 454.600 signals would be converted to 10.900 and 10.800 MHz respectively. Again the same math exercise:

2nd harmonic of 10.800	21.600 MHz
Subtract 10.900	– 10.900 MHz
	10.700 MHz

As you can see, the resultant is right on the center of the high IF, and it will go right on through the receiver filters and be demodulated, come out the loudspeaker, and annoy the radio users.

Non-Linearity Produces Effects

The aim of modern receiver design is to locate the receiver's selectivity as close to the antenna as possible. All of this second harmonic production and beating of signals can't occur at very low voltage levels. It requires non-linearity in the receiver circuits to produce these effects, and even quite non-linear devices (like bipolar transistors and diodes) don't exhibit significant deviations from linearity on extremely small signal voltages.

Once the signal gets into the receiver circuitry, it is successively amplified by the various receiver circuits, increasing in voltage until it finally reaches the discriminator. If the receiver designer can filter out the unwanted signals before they have been amplified significantly, he can keep the intermodulation problem under control. This is why it is said that the "ideal" receiver would have its selectivity elements located right at the antenna jack.

Two-to-one Spacing Relation

Note that in the above examples, one of the interfering signals was displaced from the wanted channel by 100 kilohertz, and the other one was displaced exactly twice this amount, or 200 kilohertz. The same math would have worked out if we assumed the first interfering signal to be displaced by one megahertz, and the second one by two megahertz. Just as long as the two-to-one spacing relationship is present, we can go through the same exercise and end up with an "intermod" resultant on the wanted channel.

This two-to-one spacing relationship of the interfering signals is almost always the case in real life intermodulation situations. However, intermodulation interference can result when the spacings have a three-to-two relationship. a four-to-three relationship, or many other possibilities. It can also occur as a result of the mixing of three or more interfering signals. Fortunately, these higher order types of intermodulation require substantially higher interfering signal strengths.

Excess Modulation an "Earmark"

What about the modulation on the two signals creating the intermodulation? Go back through the first examples, and assume a plus and minus 5 KHz modulation on the 454.700 MHz signal, and you will find that it shows up on the intermodulation resultant as the same plus and minus 5 KHz modulation. However, 5 KHz of modulation deviation on the 454.700 MHz signal is doubled in the intermodulation process, and shows up on the intermodulation resultant as plus and minus 10 KHz. Thus, the modulation on both of the component interfering signals shows up in the receiver output, but the modulation from one of the signals sounds (and is) twice as much as the normally used modulation deviation. Since modern receivers have bandwidths only a little more than plus and minus 5 KHz, the interfering signal swings out of the receiver bandpass on modulation peaks, and the interference we hear is typically very loud and distorted, and shows the same signs of "squelch clipping" that are observed when receiving a badly overmodulated signal. *This excess modulation on the received interfering signal is one of the earmarks of intermodulation interference.*

Once we have determined the source, or at least the frequencies of the interference, we can consider approaches for dealing with the problem: Install fancy filters, switch to a more modern receiver, move to another site, or just sit down and cry!

Identifying Interfering Signals

The knowledge we have gained through the above math exercises will help us considerably in knowing whether or not the interference being received is of an intermodulation type, and can give us some clues in identifying the interfering signals. If we hear two sets of voices on the interfering signal, with one being much the louder, intermodulation is almost certainly the culprit. If we can identify just *one* of the interfering signals in the combination, the two-to-one relationship can probably help us pinpoint the other. A simple example: Our 454.500 MHz receiver is receiving intermod interference and we caught the I.D. of one of the stations and have identified it as operating on 454.450 MHz. This is 50 MHz removed (on the low side) from our 454.500 MHz channel, so we can expect that the other signal is probably removed by two times 50 KHz, or one half of 50 KHz, also on the low side. Thus, the other culprit is probably on 454.400 or on 454.475 MHz.

Eliminating Unwanted Signals

Now that we know the frequencies of the interfering signals, we can start looking at the various approaches to eliminating the interference. The standard approach is a cavity filter put in the receiver's antenna lead. But before we spend any money on a fancy filter, we had better determine whether or not it will do any good in this case.

Figure 1 shows the selectivity curve of a filter retailing in the $100 region. If anything will do it, this baby ought to! However, in this specific case the two interfering frequencies are so close to the wanted signal that the filter can't even tell the difference between the wanted and the unwanted channels. In this case, the filter would be an impressive and costly paperweight! If, however, the interfering signals had been located one and two megahertz respectively away from our wanted channel, the filter would have attenuated one of them by 12 db, and the other by 18 db.

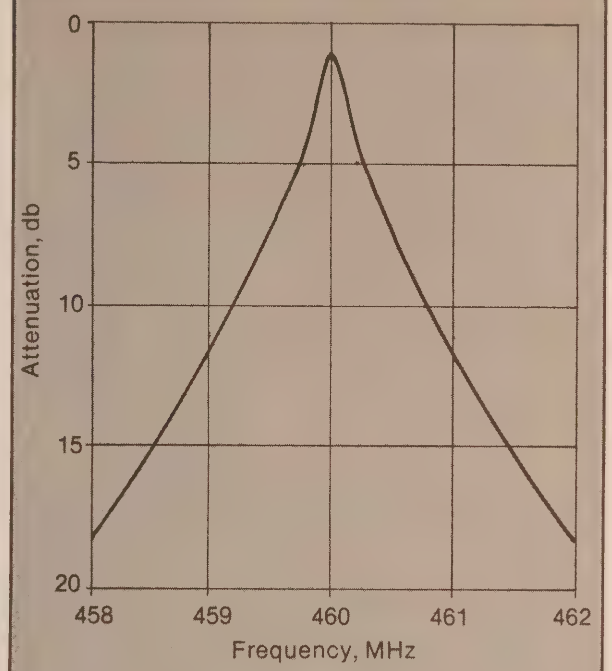


Figure 1.
Typical Coaxial Filter

Even in the second case, however, we should use a little caution before plunking down our money. We know that intermod is the problem, and we know the frequencies of the two signals creating it. But, are we sure where the intermodulation action is taking place? Of course, we would suspect our receiver first, but it may be quite innocent — especially if it is one of the more modern designs with high intermod rejection specs.

If the two offending transmitters are pretty close together, the intermod could be occurring in one (or both) of the transmitters, or in a corroded antenna connection. If so, the interfering signal will be dead on our channel and our filter won't attenuate it any more than it does our wanted signals.

Determining whether the intermod is occurring in the receiver, or is created before it reaches the receiver, has been a puzzler for most technicians. With a little further understanding about the way intermodulation happens, methods for making this determination become apparent.

Intermod Rises at Higher Rate

Back to our initial math example. Notice that before the intermod products could occur, the second harmonic of one of the interfering signals had to be generated. Then this second harmonic had to beat (or mix) against the fundamental of the other interfering signal. With the type of non-linearity involved in real life, it so happens that the amount of intermod signal generated goes up faster than the levels of the two signals. If we double the voltage of both of the two interfering signals, the intermod product voltage will go up by a factor of eight.

Put in decibels, which are easier to work with. A six decibel increase in each of the two signals results in an 18-decibel increase in the intermod resultant. Thus, if we should put a 10 db attenuator pad in the antenna input of our receiver, we would expect it to attenuate the wanted 454.500 MHz signal by 10 db. If we are observing an intermod product *created within the receiver,* the 10 db pad would result in an apparent attenuation of 30 db in the intermod reception. If the intermod product is created outside the receiver (in the antenna system, or in the offending transmitters, or in some nearby piece of rusty wire), the intermod reception would be reduced by only the 10 db of the pad — the same as with any other received signal.

Determining Source of Trouble

This gives us a nifty procedure for determining whether the intermod is happening in the receiver, or is happening elsewhere:

1) Connect a meter to the appropriate receiver limiter test point. The first limiter is preferred if the interfering intermod gives an adequate meter indication.

2) Observe the limiter reading when the intermod is heard.

3) Insert a 3 db pad in the receiver antenna lead. Observe the limiter reading when the intermod is heard.

4) Connect a signal generator operating on the wanted signal frequency to the antenna jack of the receiver, and adjust its output until the same limiter reading observed in step two is obtained.

5) Insert the 3 db pad between the signal generator and the receiver antenna port. Without changing the signal generator output, observe the limiter reading.

6) If the intermod is occurring *outside* the receiver, the limiter readings observed in steps 3 and 5 will be about the same.

7) If the intermod is occurring *inside* the receiver, the limiter reading in step 5 will correspond to a much stronger signal than the reading obtained in step 3.

If a 3 db pad isn't on hand, other size pads could be used. However, don't be surprised if the interference stops entirely when a large size pad is used. Since the pad will cut the intermod by three times the db rating of the pad, a six db pad could result in an 18 db decrease in intermod reception, and a 10 db pad could result in a 30 db decrease.

Replace Old Set if Needed

To keep this article from becoming a book-long treatise on intermod fighting, we're going to assume that the trouble is, indeed, within the receiver. What can we do about it? Of course, we would want to give the receiver a pretty thorough check up — see that the RF and mixer transistors (or tubes in an older set) are in good shape, and that the L.O. injection is normal.

If the receiver is pretty much of an antique, we should definitely consider replacing it with a more modern unit with better intermod specs. How much better? Insert added pads in the receiver antenna lead until the intermod disappears. The amount of attenuation needed is a guide to the amount of improvement required.

Cavity Filter May Do the Job

If the interfering signals are about 1/2 percent or more displaced in frequency from the wanted channel, one of the many available coaxial cavity filters may do the job. Again, we can get an idea of how much attenuation we need at the interfering signals by experimenting with the amount of attenuation pad needed in the receiver antenna lead to remove all traces of the interference. If the filter will provide that amount of attenuation at the nearest of the interfering signals, it will provide still more at the other one, and will eliminate the problem with considerable margin to spare. Simple experimentation with antenna attenuation pads, plus an inspection of the manufacturer's curves on the filters will take the guesswork out of ordering the proper filter.

Since modern receivers already have fairly selective input circuits, many intermod problems can't be solved by adding cavity filters. If the signals are close enough to the wanted channel frequency to get through the receiver filters, they may be too close to filter out with added coaxial filters. To handle this, some quartz crystal manufacturers offer crystal filters that operate clear up through VHF frequencies, and can be placed right in the antenna lead to the receiver. These filters must be ground to the exact channel frequency, and they don't come free with a box of breakfast cereal!

Antenna Pad Could be Answer

In a few special situations, an antenna pad in the receiver antenna line might be all that is needed. This may sound like heresy after all the trouble the designers went to in order to have that last tenth of a microvolt of sensitivity, but there are some cases where it won't degrade the system performance a bit.

Consider the case of a control station for a mobile relay type system; with the directional antenna required by the FCC rules, the receiver probably has a lot more signal coming from the relay than required. A 10 or 20 db pad in the receiver line might still permit perfect reception from the mobile relay station, and will knock out an extremely bad case of intermod. Consider a low band, or a 150 MHz, base station located in the center of a business district. Even if the receiver is capable of a quarter microvolt or better sensitivity, local noise may limit effective sensitivity to something like one or two microvolts. In such a case, six db (or even more) of extra loss in the receiver antenna line might not produce any effective loss of system range, but it could provide the cure for a serious intermod problem.

Just so the people that make those expensive filters won't hate me too much, however, I do want to warn you to *measure* effective system sensitivity both before and after adding the pad, by injecting a signal into the antenna line with the antenna connected.

Regency COMMUNICATIONS, INC.

XLU TUNE UP

RX

1. At M3 adj. C204 for 6.5 volts.

2. At M4 adj. L600 for min. voltage (approx. +7.5v).

3. At R600 (with a freq. counter) adj. C617 for operating freq. - 21.4 Mhz ÷ 2. E.G. Fl Rx 464.000 Mhz - 21.4 = (442.600) ÷ 2 = 221.300 MHz.

4. At pin 10 of 1C 400 adj. L415 for +3.5 volts.

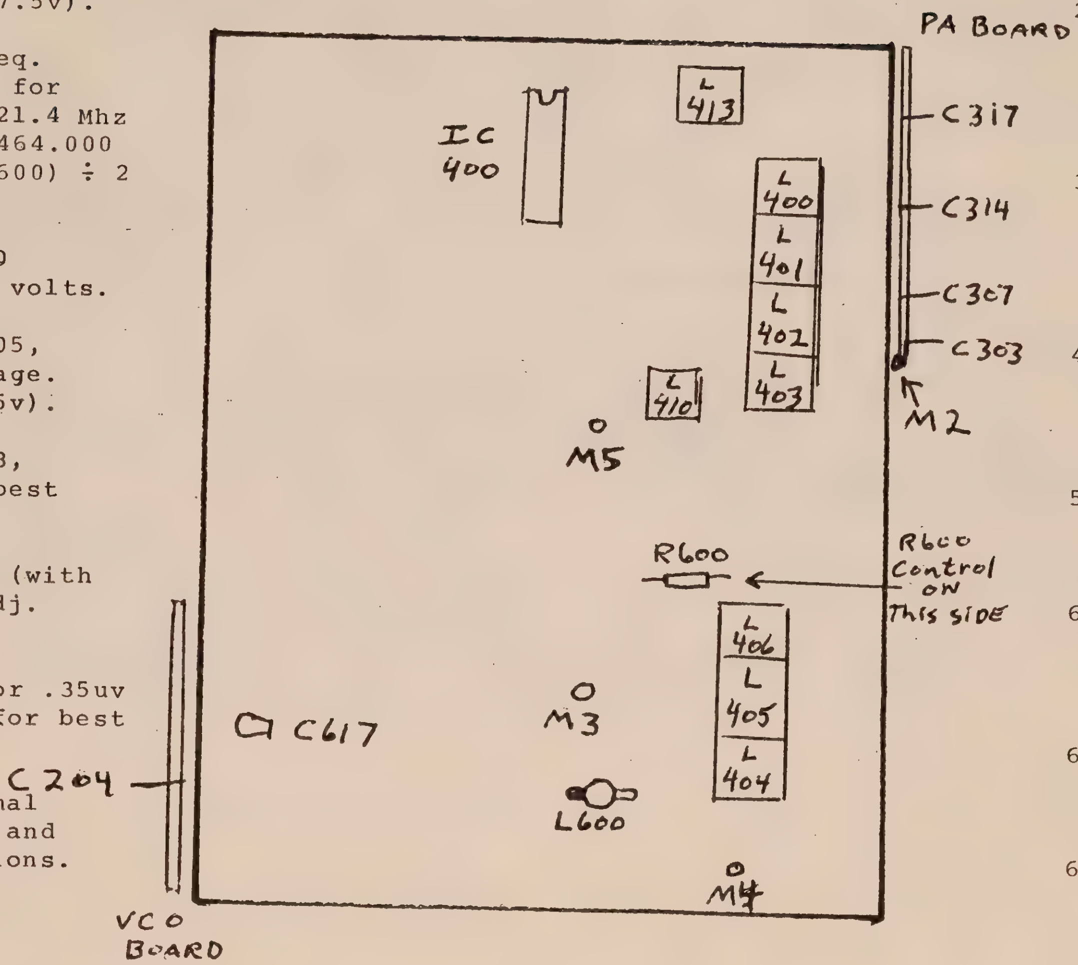
5. At M5 adj. L404, 405, 406, for min. voltage. (approx. +7.0 - 7.5v).

6. Adj. L406, 410, 413, 400, 401, 402 for best 12 db Sinad.

7. At pin 5 of 1C 400 (with a freq. counter) adj. C617 for 455 KHz.

8. Re-set generator for .35uv and repeat step 6 for best 12 db Sinad.

9. Check unit for normal quieting, squelch, and tone decode operations.


PA BOARD
C317
C314
C307
C303
M2
IC 400
L 413
L 400
L 401
L 402
L 403
L 410
M5
R600
R600 Control ON This SIDE
L 406
L 405
L 404
M3
C617
C204
L600
M4
VCO BOARD

TX

1. At M3 check voltage (approx. +5.0v - 5.5v).

2. At M2 adj. L501, 502, 600 and C504 for max. voltage (approx. +1.5v - +4.0v).

3. Adj. C303, 307, 314, 317 on PA deck for best power @ min. current.

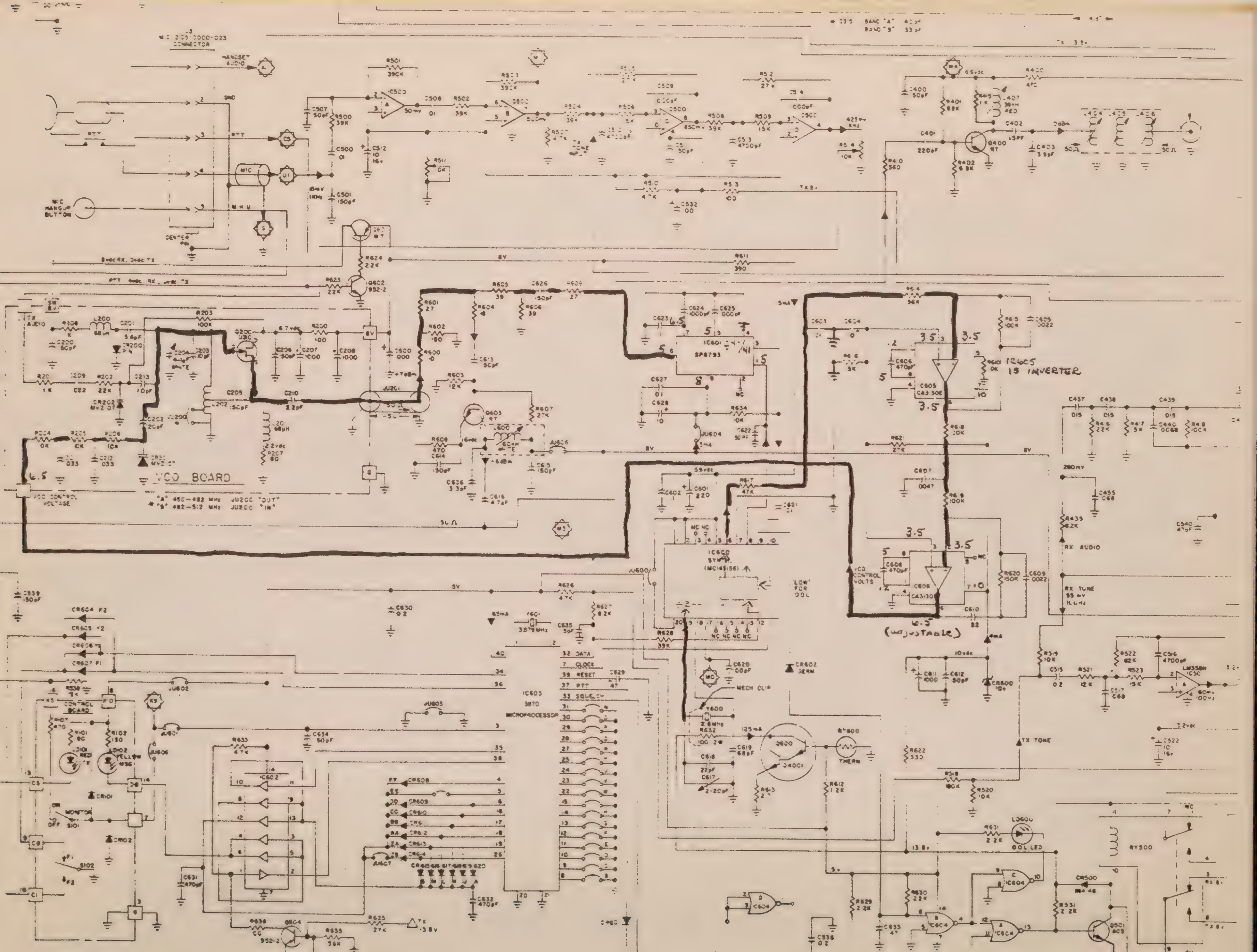
4. Repeat steps 2 and 3 for best power and efficiency.

5. Adj. C617 for proper operating frequency.

6a. Adj. R532 for tone deviation (if used) 500-750 hz.

6b. Adj. R514 for mic deviation 5 KHz maximum.

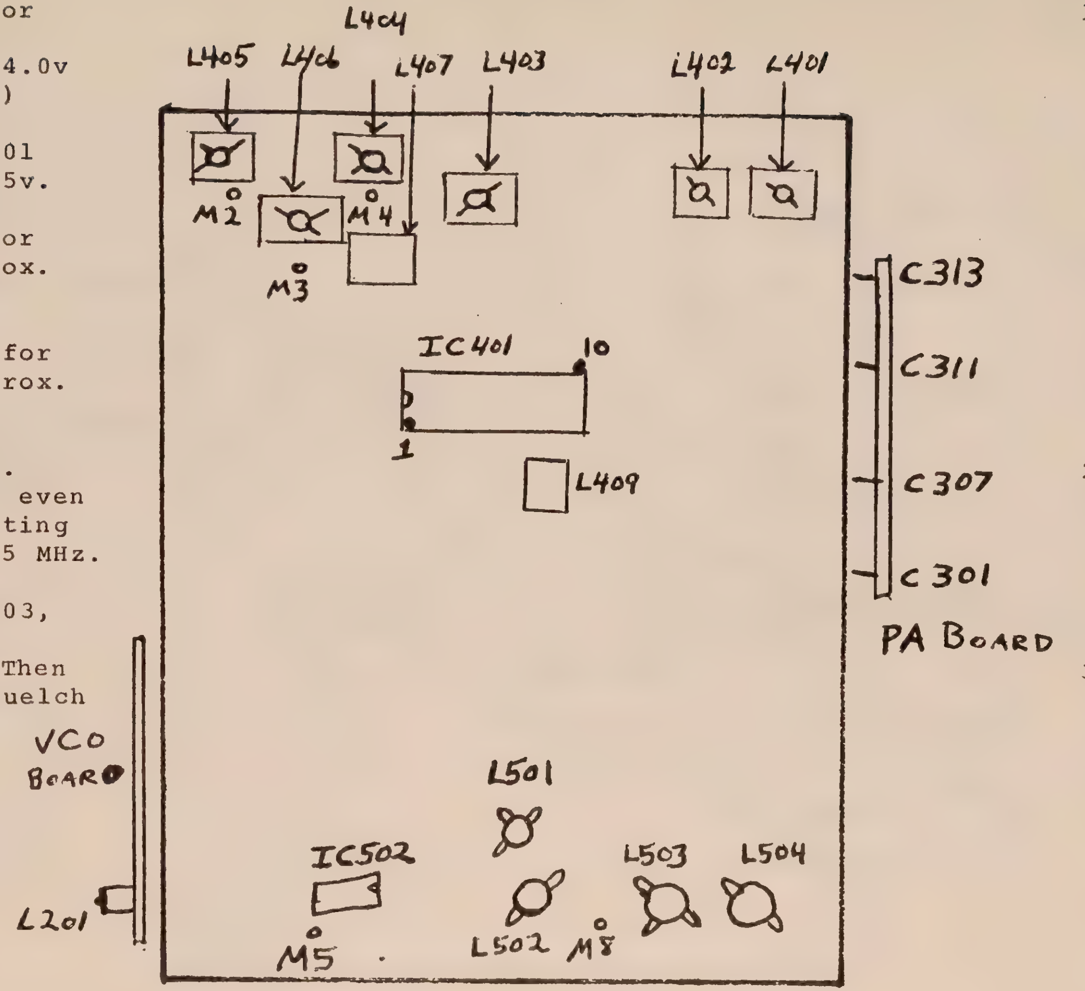
6c. Adj. R511 for best symmetry.


MIC 2105-0000-023 CONNECTOR
HANDSET AUDIO
MIC HANGUP BUTTON
CENTER
PTT
MIC
8Vdc RX, 0Vdc TX
PTT 0Vdc RX, 8Vdc TX
BAND "A" 40pF
BAND "B" 33pF
TX 3.9v
TX AUDIO
VCO BOARD
VCO CONTROL VOLTAGE
"A" 450-482 MHz JU200 "OUT"
"B" 482-512 MHz JU200 "IN"
6.5
5
3.5
IC601 SP8793
IC605 IS INVERTER
IC605 CA3130E
IC606 CA3130
IC600 SYNTH. (MC145156)
LOW FOR DOL
VCO CONTROL VOLTS
6.5 (adjustable)
IC603 3870 MICROPROCESSOR
32 DATA
7 CLOCK
39 RESET
37 PTT
33 SQUELCH
Y601 3.579 MHz
Y600 12.8 MHz
MECH CLIP
THERM
RX AUDIO
RX TONE
TX TONE
CONTROL BOARD
MONITOR
DOL LED
RY500
LM358N

XLH 252/257 TUNE-UP

RX

1. At M5 adj. L201 for peak voltage (approx. +3.5 - +4.0v at power up freq.)
2. At Pin 10 of IC 401 adj. L409 for +3.5v.
3. At M2 adj. L405 for min voltage (approx. +1.5v)
4. At M3, adj. L406 for peak voltage (approx. +2.0v).
5. At M4 with a freq. counter adj. C518 even C520 odd to operating freq. Less 10.695 MHz.
6. Adj. L401, 402, 403, 404, 407 for 12DB Sinad at .35uv. Then check quieting squelch and decode.


L404
L405
L406
L407
L403
L402
L401
M2
M4
M3
IC401
10
1
L409
C313
C311
C307
C301
PA BOARD
VCO BOARD
L201
IC502
M5
L501
L502
M8
L503
L504

TX

1. At M8 adj. L501 and L502 for peak voltage (approx. +.8 to +.9v)

   Adj. L503 for minimum voltage (approx. +.4 to +.5v)

   Adj. L504 for peak voltage (approx. +.65 to +.8v)
2. Adj. P.A. Deck Trimmers C301, 307, 311, 313 for max. power output at minimum current.
3. Repeat Steps #1 and #2 for best power at min. current.

MCL 60 TUNE-UP

RX

1. At A0 (no signal) adj. L209 for 3.5v.

NOTE: All other Rx adj. are done with Sig. Gen. set up at Tune up freq. modulated with 1 KHz of tone @ 3KHz deviation unless otherwise stated.

2. Adj. L211 for best 12 db Sinad.

3. Adj. L205 for best 12 db Sinad.

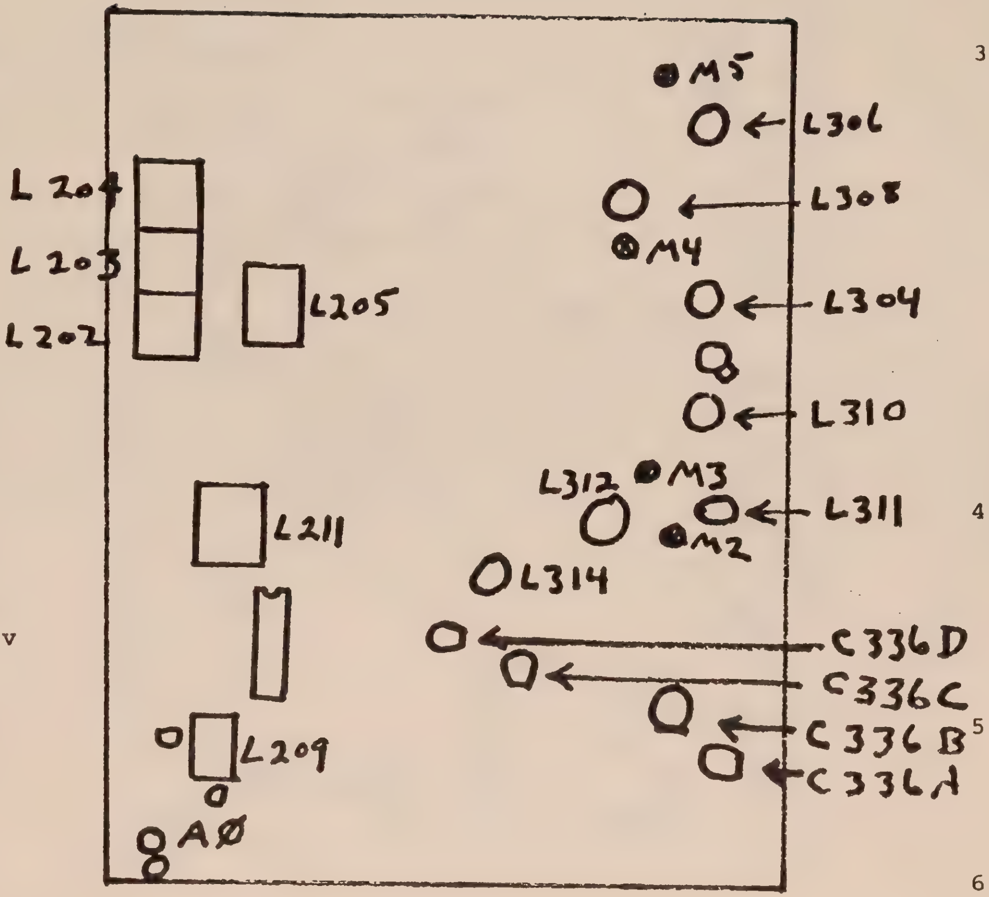
4. Adj. L202, 203, 204, for best 12 db Sinad.

NOTE: Set Sig. Gen. for .5uv level.

5. Repeat Steps 2, 3, and 4.

6. Sig. Gen. should read no greater than .35 uv for 12 db Sinad.

7. Check unit for proper quieting and squelch.


M5
L306
L308
M4
L304
L310
L312
M3
L311
M2
L314
C336D
C336C
C336B
C336A
L204
L203
L202
L205
L211
L209
A0

TX

1. Pre-tune C336 as shown.

2. Pre-tune L314 10 turns C.W. from top of core.

3. At M3 adj. L312 for a slight dip in volt (approx. .1 - .3v).

   Adj. L314 for min. voltage (approx. +9.5v).

   Adj. L311 for max. voltage (approx. +10.0v).

   Adj. L310 for min. voltage (approx. +9.0v).

4. At M4 adj. L304 for max. voltage (approx. +9.5v).

   Adj. L308 for min. voltage. (approx. +8.5 - 9.0v).

5. Adj. L306 for max. power. Adj. trimmer on P.A. for best power out @ min. current.

6. Repeat steps 4 & 5 for best efficiency

7. Adj. C336 (a,b,c,d, for proper freq.

MCH 40 TUNE-UP

RX

1. At A0 (no signal) adj L213 for 3.5V.

NOTE: All other RX adj. are done with Sig. Gen. set at tune-up freq. modulated with 1 KHz of tone @ 3 KHz deviation unless otherwise stated.

2. Adj L201 (A,B,C,D) for best 12dB Sinad.

3. Adj L206,208,209, and 211 for best 12dB Sinad.

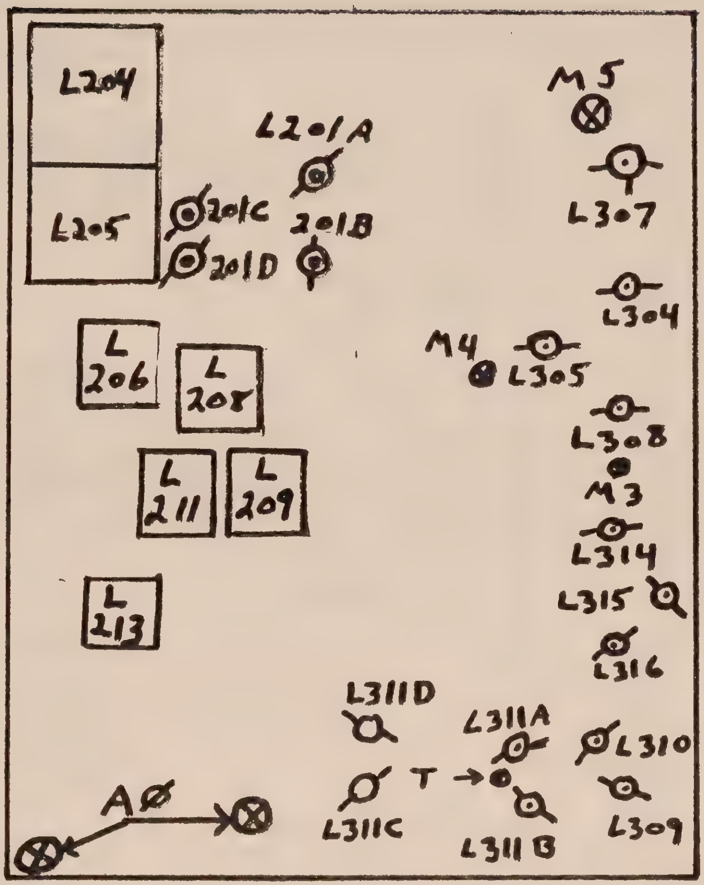
4. Adj L205 and 206 for best 12dB Sinad.

NOTE: Set Sig. Gen. for .5µv level.

5. Adj L201 (A,B,C,D) for best Sinad.

6. Sig. Gen. should read no greater than .35µv for 12dB Sinad.

7. Check unit for proper quieting and squelch.


L204
L205
L201A
201C
201B
201D
M5
L307
L304
M4
L305
L308
M3
L314
L315
L316
L206
L208
L211
L209
L213
L311D
L311A
L310
L311C
T
L311B
L309
A0

TX

1. At M3 adj L315,309, 310 and 316 for min voltage (approx. +12 volts).

2. At M4 adj L314 and 308 for min voltage (approx. +11 volts).

3. At M5 adj L304 for min volt (approx. +12.5V).

4. Adj L307 for max. power.

5. Adj C111 and C117 (PA deck) for max. power @ min. current.

6. Repeat Steps 4 and 5 for best efficiency.

7. Adj L311 (A,B,C,D) for proper freq.

TX

1. At M1 adj. L304-305 for min. voltage (approx. +1.75v)

NOTE: All other Tx adj. are done with meter Common (-) at A+ (meter set a -DCV) unless otherwise stated.

2. At M2 adj L306 & 307 for peak (-) voltage (approx. -2 volts) adj. L310 for min. voltage (approx. -1.5 volts).

3. At M3 adj. L312 & 311 for peak (-) voltage (approx. -6 volts) adj. L316 for min. voltage (approx. -3.5v).

NOTE: Pre-set C348 as shown.

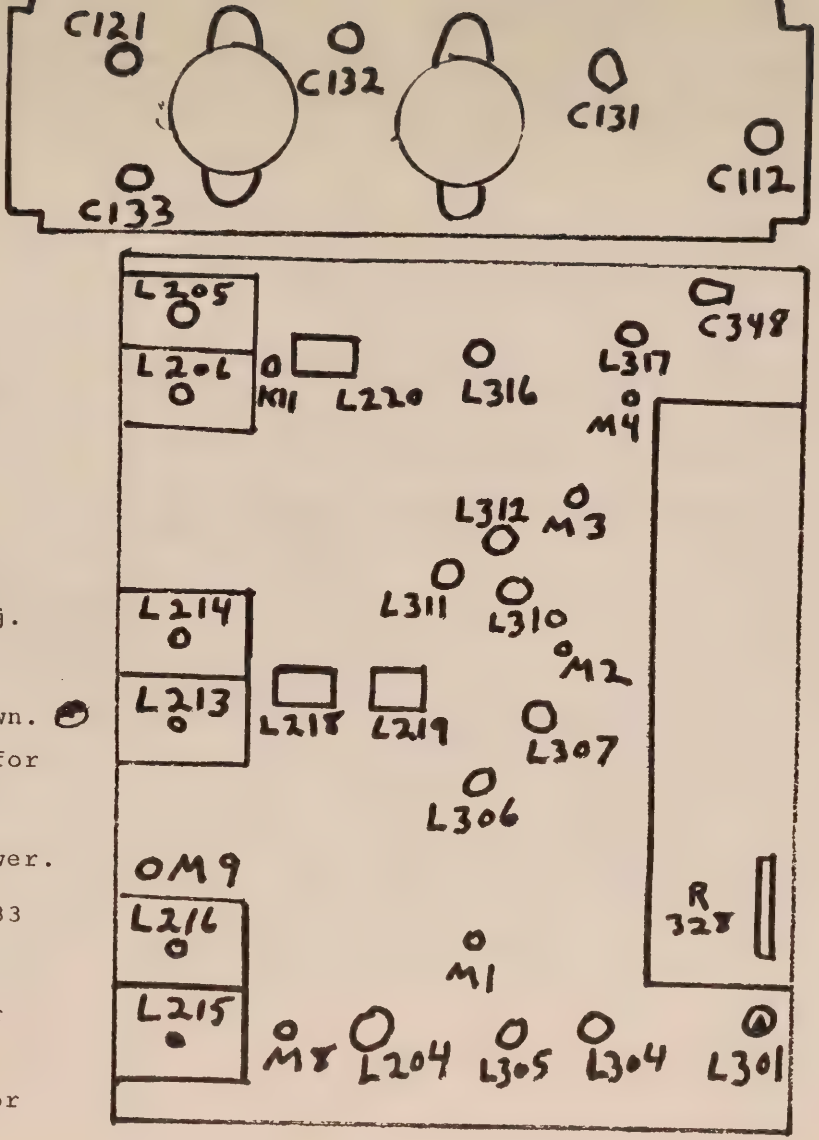
4. At M4 adj. L317 +316 for peak (-) voltage (approx. -1.5 volts)

5. Adj. C348 for max. power.

6. Adj. C112, 121, and 133 for max. power & min. current.

7. Repeat steps 5 & 6 for best efficiency.

8. Adj. L301 (a,b,c,d) for proper freq.


C121
C132
C131
C133
C112
L205
L206
K11
L220
L316
L317
C348
M4
L312
M3
L311
L310
M2
L214
L213
L218
L219
L307
L306
M9
L216
M1
R 328
L215
M8
L204
L305
L304
L301

MCU TUNE UP

RX

1. At pin 10 - 1C 201 (no signal) adj. L220 for +3.5v

NOTE: All other Rx adj. are done with Sig. Gen. set at Tune Up freq. modulated with 1 Khz of Tone @ 3KHz deviation unless otherwise stated

2. At M8 adj. L204 for min. voltage (approx. +3.4-4.0v).

3. Adj. L205, 206, 212, 213 215 & 216 for best 12db Sinad.

4. Adj. L218, 219 for best 12db Sinad (slugs should be set at top of cores).

NOTE: Set Sig. Gen. for .5uv level.

5. At K11 adj. L201 (a,b,c, d) for +3.5v.

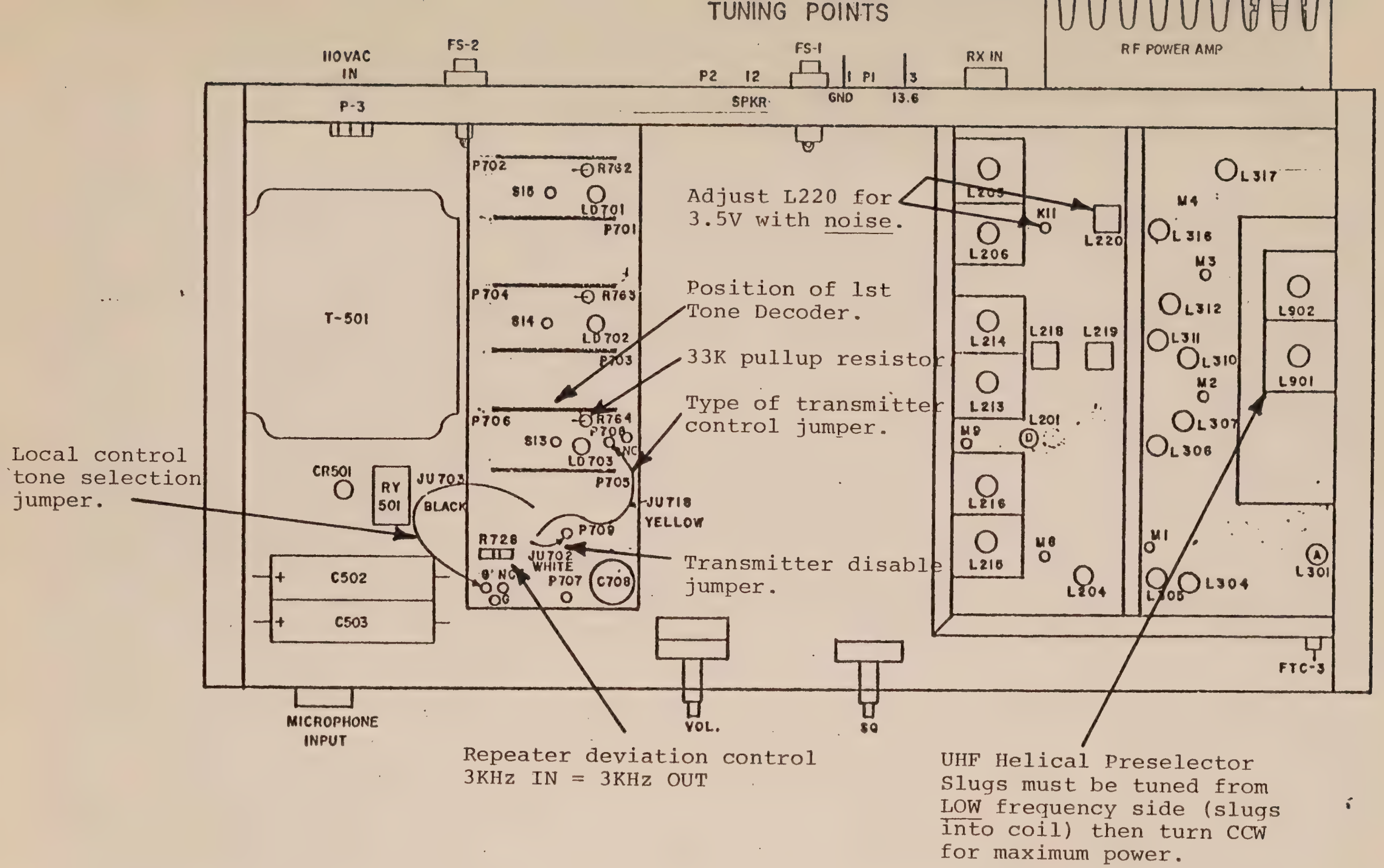
6. Set Sig. Gen. for 6 Khz dev. adj. L218 & 219 for best 12 db Sinad.

NOTE: Reset Sig. Gen. for 3 KHz dev.

7. Sig. Gen. should read no greater than .35uv for 12 db Sinad.

8. Check unit for proper Quieting & Squelch.

TUNING POINTS


110VAC IN
FS-2
P2
12
FS-1
1
P1
3
RX IN
RF POWER AMP
P-3
SPKR
GND
13.6
P702
R732
S15
LD701
P701
P704
R763
S14
LD702
P703
P706
R764
P708
NC
S13
LD703
P705
T-501
CR501
RY 501
JU703
BLACK
JU718
YELLOW
R728
P709
JU702
WHITE
P707
C708
NC
G
C502
C503
L205
L206
K11
L220
L214
L218
L219
L213
L201
M9
L216
L215
M8
L204
L317
M4
L316
M3
L312
L311
L310
M2
L307
L306
M1
L305
L304
L902
L901
L301
FTC-3
MICROPHONE INPUT
VOL.
SQ

Adjust L220 for 3.5V with noise.

Position of 1st Tone Decoder.

33K pullup resistor

Type of transmitter control jumper.

Local control tone selection jumper.

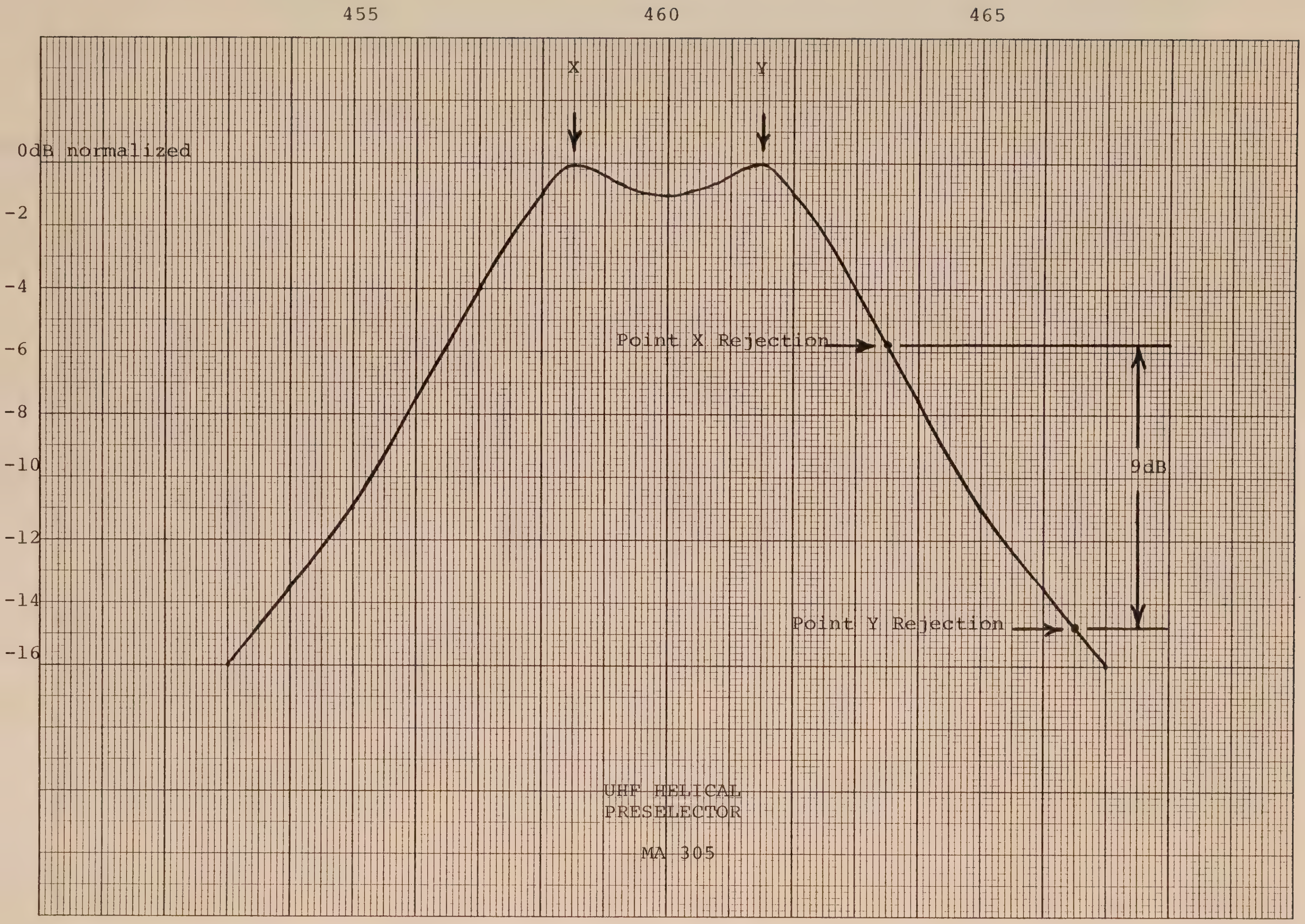
Transmitter disable jumper.

Repeater deviation control
3KHz IN = 3KHz OUT

UHF Helical Preselector Slugs must be tuned from LOW frequency side (slugs into coil) then turn CCW for maximum power.

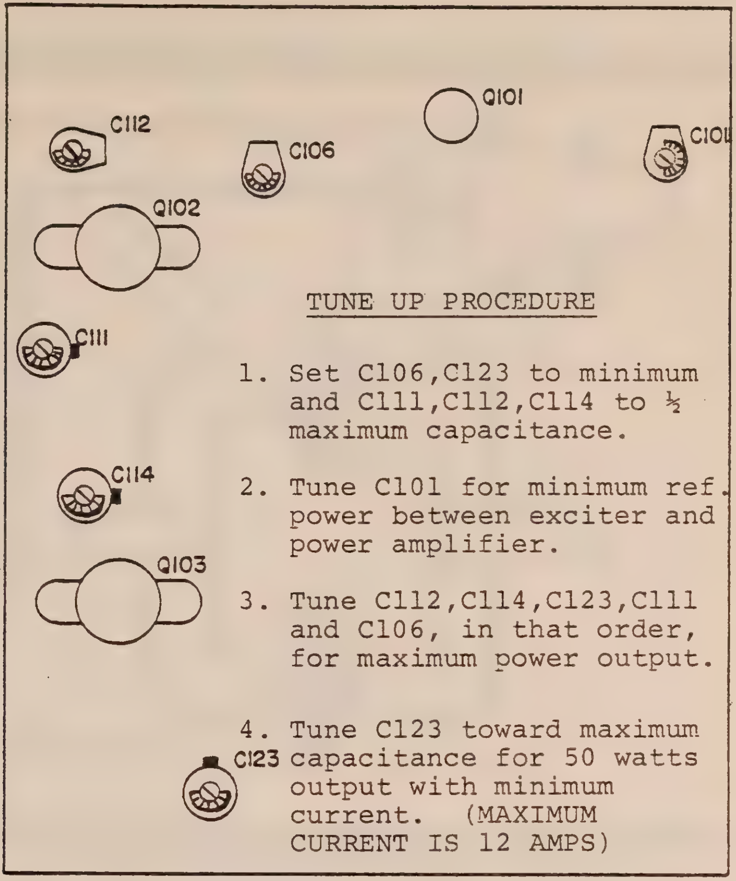
MCCU15R

KEUFFEL & ESSER CO. MADE IN U.S.A.



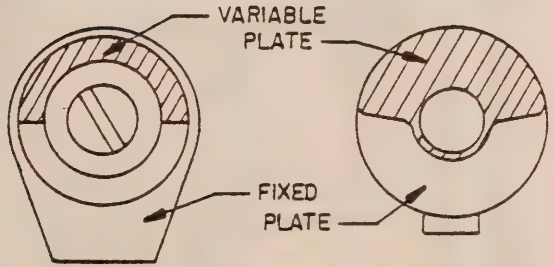
UHF HELICAL
PRESELECTOR

MA 305


Q101
C112
C106
C101
Q102
C111
C114
Q103
C123

TUNE UP PROCEDURE

1. Set C106,C123 to minimum and C111,C112,C114 to ½ maximum capacitance.
2. Tune C101 for minimum ref. power between exciter and power amplifier.
3. Tune C112,C114,C123,C111 and C106, in that order, for maximum power output.
4. Tune C123 toward maximum capacitance for 50 watts output with minimum current. (MAXIMUM CURRENT IS 12 AMPS)

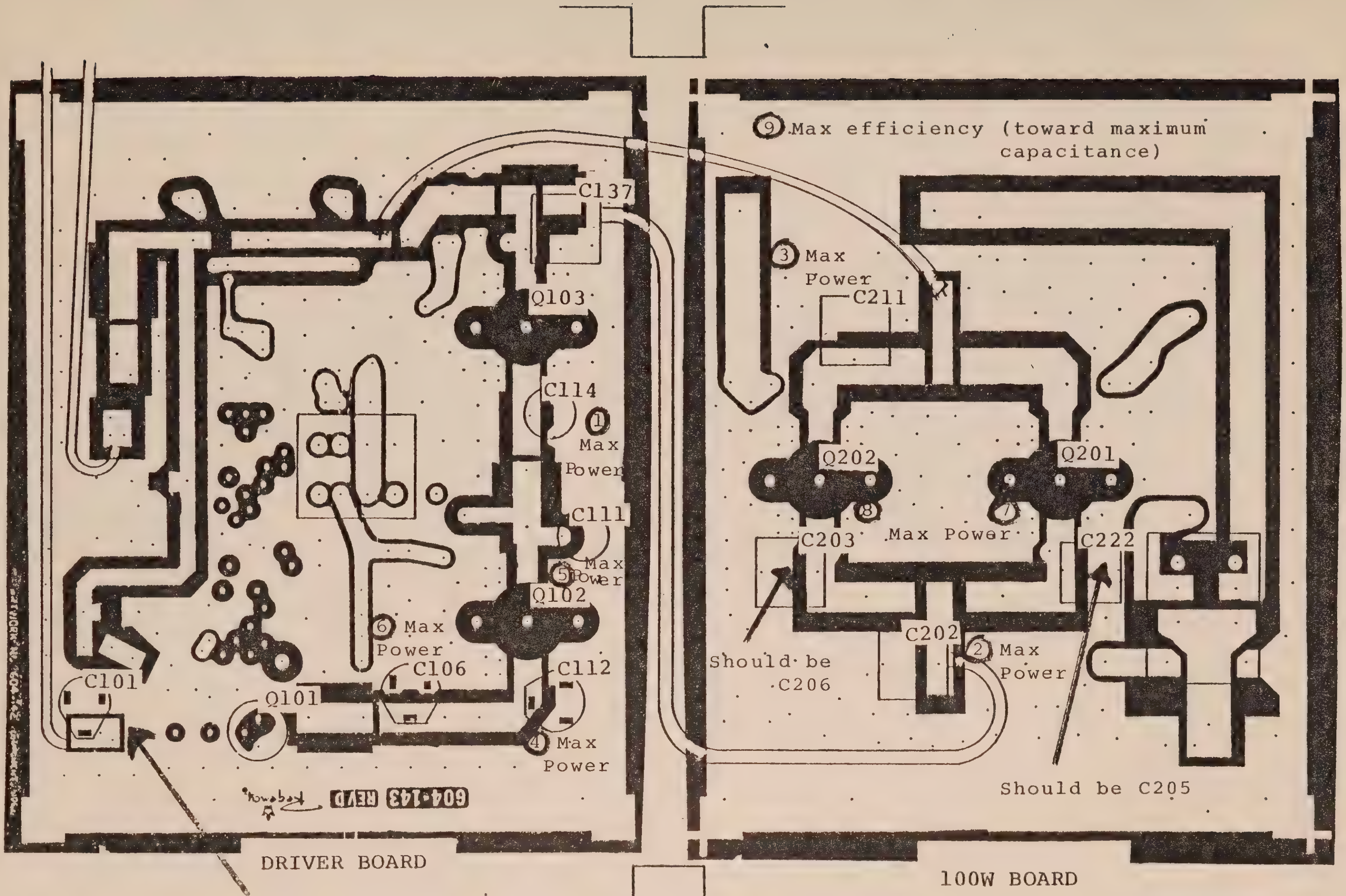

VARIABLE PLATE
FIXED PLATE

STYLE OF C106&C112 STYLE OF C111,C114&C123

MINIMUM CAPACITANCE SETTING

TUNING ADJUSTMENT LOCATIONS ACU-45

DRAWN CMcC	DATE 9-24-79	SIZE A	PART NUMBER TP 14-248	REV. B
APPROVED DLF	DATE 11/13/79			
DO NOT SCALE DWG.		SCALE ~		SHEET 4


C137
Q103
C114
C111
Q102
C112
C106
C101
Q101
604-143 REV D
DRIVER BOARD
C211
Q202
Q201
C203
C222
C202
100W BOARD

⑨ Max efficiency (toward maximum capacitance)

① Max Power

③ Max Power

② Max Power

④ Max Power

⑤ Max Power

⑥ Max Power

⑦

⑧ Max Power

Should be C206

Should be C205

Minixum reflected power between exciter & power amp.

TUNING CAPACITOR LOCATIONS

ACU100
AASCU100

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W = White B = Blue
G = Green Y = Yellow

XLH 252

PRODUCT	PROBLEM	SERVICE BULLETIN #	COLOR
LH 252	To facilitate 5.26 MHz spacing in half duplex mode.	80-171	G
LH 252	Self Quieting Spur frequencies	80-180	G
LH 252	Failure of synthesizer (IC 511) during normal operation.	80-181	G
LH 252	Excessive low frequency deviation of carrier on transmit when radio is near transmit antenna.	80-182	G
LH 252	Microprocessor failure due to static electricity in low humidity conditions	80-184	G
LH 252 rior to erial #2147	Transmitter problems when a supply line choke is used.	80-185	G
LH 252	Excessive low frequency deviation of the carrier on transmit caused by sources such as alternator whine, vibration, etc.	81-194	G
LH 252	Microphone sensitivity in a noisy environment.	81-199	G
	XLH-257		
LH 257	Excessive low frequency deviation of the carrier on transmit caused by sources such as alternator whine, vibration, etc.	81-194	G
LH 257	Microphone sensitivity in a noisy environment	81-199	G

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MCBU 19, 35

PRODUCT	PROBLEM	SERVICE BULLETIN #	COLOR
CBU 19, 35	No transmitter disable with MA 130 installed	80-189	B
CBU 19 A, B CBU 35A, B	No transmitter output power from channel 2 when the ambient temperature is cold.	81-190	B
CBU 19 CBU 35 ith 704-064 ain board	Transmitter unstable, low power transmit, power varies, difficult broadband tuning	81-191	B
CBU 19, 35	Squelch opens on some radios at cold temperatures	81-197	B
	MCU 10R		
CU 10R	Audio Transcients	78-0146	B
CU 10R one/Control Board	adding anti-false circuit to tone decoders requiring tone plus carrier to activate repeater.	80-166	W
CU 10R one/Control Board	Improve audio transfer characteristics	80-167	W
	MCCU15R		
CCU15R	Squelch opens on some radios at cold temperatures	81-0197	B

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PRODUCT	PROBLEM	SERVICE BULLETIN #	COLOR
	MCL 60		
MCL 60	Replacement on/off controls and squelch controls	79-0162	W
MCL 61A, B, C MCL 64A, B, C	Receiver desense, distortion and squelch blocking in presence of strong signal.	80-0170	W
MCL 61A, B, C MCL 64A, B, C	Deterioration of sound quality due to loss of high frequency response.	80-0173	Y
MCL 30, 60	Problems when using MA 127, 128, or 129	80-0183	W
	XLU 152		
XLU 152	Microphone sensitivity in a noisy environment	81-199	G
XLU 152A	Material change for Q401 from A 4801-3432-300 to A 4801-3434-200	81-200	B
	MCPU SERIES		
MCPU	Setting transmit frequencies on 4 channel radios.	81-201	B

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MCH SERIES

PRODUCT	PROBLEM	SERVICE BULLETIN #	COLOR
ICH 44 /MA-129 and MA-164 or IA-165	Noise burst on Priority Channel	78-0144	G
ICH 40	Wiring of second option switch with 2 options requiring a switch	78-0148	G
ICH 40	Squelch Blocking	78-0152	G
ICH 40B	Transmitter stability and bandwidth	78-0153	G
ICH 40	Squelch popping under tight squelch conditions. Receiver attack and squelch closing time	78-0155	G
ICH 40	New schematic	79-0157	G
ICH 40	Replacement on/off controls and squelch controls	79-0162	W
ICH 40 ersion I, II	Alternator Whine in receiver output	79-0164	G
ICH 40 PA	Parts changes for improved quality	80-0176	G
ICH 40	Mechanical and Hardware Parts List	80-0187	G
ICH 40 /MA 126, MA 79	Bassey Transmit audio	79-0158	W

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MCV SERIES

PRODUCT	PROBLEM	SERVICE BULLETIN #	COLOR
MCV 21C	Squelch Lockup	78-0145	G
MCV 20	Shipment of BTH Service Manuals instead of MCV Manuals.	78-0150	G
MCV 21H MCV 21CH MCV 22H MCV 22CH MCV 24H	High Range (162-174 MHz) Micro-Com transmitter not tuning properly	78-0154	G
	BTH SERIES		
BTH 201 BTH 202	Shipping BTH Service manuals instead of MCV manuals to all MCV and BTH users.	78-0150	G
BTH 201B W/MA 116	No encode tone when Tx is keyed.	80-179	W
	TRH 200		
TRH 200	M3 Voltage low or low deviation	81-196	G

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OPTIONS AND TONES

PRODUCT	PROBLEM	SERVICE BULLETIN #	COLOR
MA 56, 57, 70, 91, 93 When used w/remote control	Audio feed through problem on transmit with remote units	78-0147	W
All current models	Available service information	78-0149	W
E & R Tone Wideband Receivers	Filters	78-0151	G
MA 126, MA 79 Handset used with MCH 40, MCU 30	Bassey Transmit Audio	79-0158	W
MA 305 Helical Preselectors	Revised MA 305 Service Manual	79-0159	W
P1412 and MCB/CBS Base Stations	SCR overvoltage circuit failure in P1412	79-0161	W
MA 114, 115, 146, 164 Mic Hangup	Intermittent CTCSS Operation	79-0163	W
MA 116 Board 504-046 REV. A & B	Changes necessary when using in Repeater with tone control board	80-168	B
MA 147 Board 1700-5416-000 Rev. C	False Decoding	80-169	W
MA 177 Imp. Adapter	Hum on transmit and receive audio	80-172	W
P1412 Power Supply	Definition of circuit changes. Revisions A,B,C	80-177	W
MA-116 P.C. Board 504-046 REV. "C" only	Low receive sensitivity after transmitter is keyed.	80-178	W
P1412 Power Supply	Definition of circuit changes. Revision D	80-188	W
MA 318, 178	Transmitter keys when handset is lifted	81-192	W

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OPTIONS AND TONES

PRODUCT	PROBLEM	SERVICE BULLETIN #	COLOR
A 319	Remote base with tone will not go into monitor mode if used with local microphone.	81-193	W
1412 ev. C and D	High line voltage causes Power Supply SCR to fire and shut off output.	81-195	W

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MCU 15, MCU 30

PRODUCT	PROBLEM	SERVICE BULLETIN #	COLOR
MCU 15, MCU 30	Squelched Noise Hiss and poor squelch characteristics	78-0156	B
MCU 30 W/MA 126, MA 79	Bassey Transmit Audio	79-0158	W
MCU 15, 30	JO numbers on schematic are different than option installation instruction.	79-0160	B
MCU 15, 30	Replacements on/off controls and squelch circuits.	79-0162	W
MCU 30 Version I, II	Alternator whine in receiver output	79-0165	G
MCU 30, 30 II	Transient frequency shift when transmitter is keyed.	80- 175	W
MCU 15, 30	Problems when using MA 127, 128, or 129	80-183	W
MCU 34H MCU 18	No Tx output power from channel 2 when the ambient temperature is cold.	81-190	B
MCU-15, 18, 31, 34	Squelch opens on some radios at cold temperatures	81-197	B
	MCU01, MCU04, MCCU-01R		
MCU01 - MCU04 MCCU-01R	Squelch opens on some radios at cold temperatures	81-197	B

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SERVICE BULLETINS

78-0144(G)	MCH-44 with MA-129 and MA-164 or 65 installed noise burst on priority channel.
78-0145(G)	MCV21C Squelch Lock-up
78-0146(B)	MCU10R Audio Transcients
78-0147(W)	MA56, 57, 70, 91, 93 when used with Remote Control Audio feed through problem on Tx with remote units.
78-0148(G)	MCH-40 Wiring of second option switch W/2 options requiring a switch.
78-0149(W)	All current models available service information.
78-0150(G)	MCV20 series, BTH201, BTH202 Shipment of BTH service manuals instead of MCV manuals.
78-0151(G)	E and R Tone Wideband Receivers filters
78-0152(G)	MCH40 Squelch Blocking
78-0153(G)	MCH40B Transmitter Stability and Operating Bandwidth
78-0154(G)	MCV21H, MCV22H, MCV24H, MCV21CH High range (162-174 MHz) Micro-com Tx not tuning properly.
78-0155(G)	MCH40 Squelch Popping under tight squelch conditions, receiver attack and squelch closing time.
78-0156(B)	MCU15, MCU30 Squelch noise hiss and poor squelch characteristics
79-0157(G)	MCH40 New schematic
79-0158(W)	MA126, MA79 Handset used with MCH40, MCU30 Bassey Tx Audio

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SERVICE BULLETINS

80-189(B)	MCBU 19, MCBU 34 No transmitter disable with MA-130 installed.
81-190(B)	MCU 18, MCU 34, 34H, MCBU 19A,B, MCBU 35A, B No Tx output power from Channel 2 when the ambient temperature is cold.
81-191(B)	MCBU15, MCBU30, MCBU19, MCBU35, W/704-064 Main Board. Tx unstable, low power Tx, Power varies, difficult broad band tuning.
81-192(W)	MA-318, MA-178 Tx keys when handset is lifted.
81-193(W)	MA 319 (on back sheet of 81-192) Remote Base W/tone will not go into monitor mode if used with local microphone.
81-194(G)	XLH 252, XLH 257 Excessive low frequency deviation of the carrier on Tx caused by sources such as alternator whine, vibration, etc.
81-195(W)	P1412 Power Supply - Revision C and D High line voltage causes Power Supply SCR to fire and shut off output.
81-196(G)	TRH 200 M3 voltage low or low deviation.
81-197(B)	MCU15, 18, 31, 34 MCBU 19, 35 MC01, MC04, MCU01R, MCU15R Squelch opens on some radios at cold temperatures.
81-198	Not Released.
81-199(G)	XLH 252, XLH 257, XLU 152 Microphone sensitivity in a noisy environment.
81-200(B)	XLU152A Material change for Q401, from A 4801-3432-300 to A4801-3434-200
81-201(B)	MCPU Series (Portable) Setting Tx frequencies on 4 channel radios.

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SERVICE BULLETINS

79-0159(W)	MA-305 helical Preselectors Revised MA-305 service manual.
79-0160(B)	MCU-15, MCU-30 JO numbers on schematic are different than option installation instruction.
79-0161(W)	P1412 Power Supply and MCB/CBS Base Stations SCR overvoltage circuit failure in P1412 power supplies.
79-0162(W)	MCH-40, MCU-30, MCU-15, MCL-60 Replacement on/off controls and squelch controls.
79-0163(W)	Mic Hang Up W/MA-114, 115, 146, 164 Intermittent CTCSS operation.
79-0164(B)	MCU-30 Version I and II Alternator Whine in Receiver output.
79-0165(G)	MCH-40 Version I and Version II Alternator Whine in Receiver output
80-166(W)	MCU10R Tone/Control Board Adding anti-false circuit to tone decoders requiring tone plus carrier to activate repeater.
80-167(W)	MCU-10R Tone/Control Board Improve audio transfer characteristics.
80-168(B)	MA-116 Encoder/Decoder Board 504-046 Rev. A & B. Changes necessary when using in repeater with tone control board.
80-169(W)	MA-147, 2805 Tone Decoder, P.C. Board 1700-5416-000 Rev. C. False Decoding
80-170(W)	MCL-61A,B,C, MCL-64A,B,C Receiver desense, distortion and squelch blocking in presence of strong signal.
80-171(G)	XLH-252 to facilitate 5.26 MHz spacing in half duplex mode.
80-172(W)	MA-177 Impedence adaptor hum on Tx and Rx audio.
80-173(Y)	MCL-61, A,B,C, MCL-64A,B,C Deterioration of sound quality due to loss of high frequency response.

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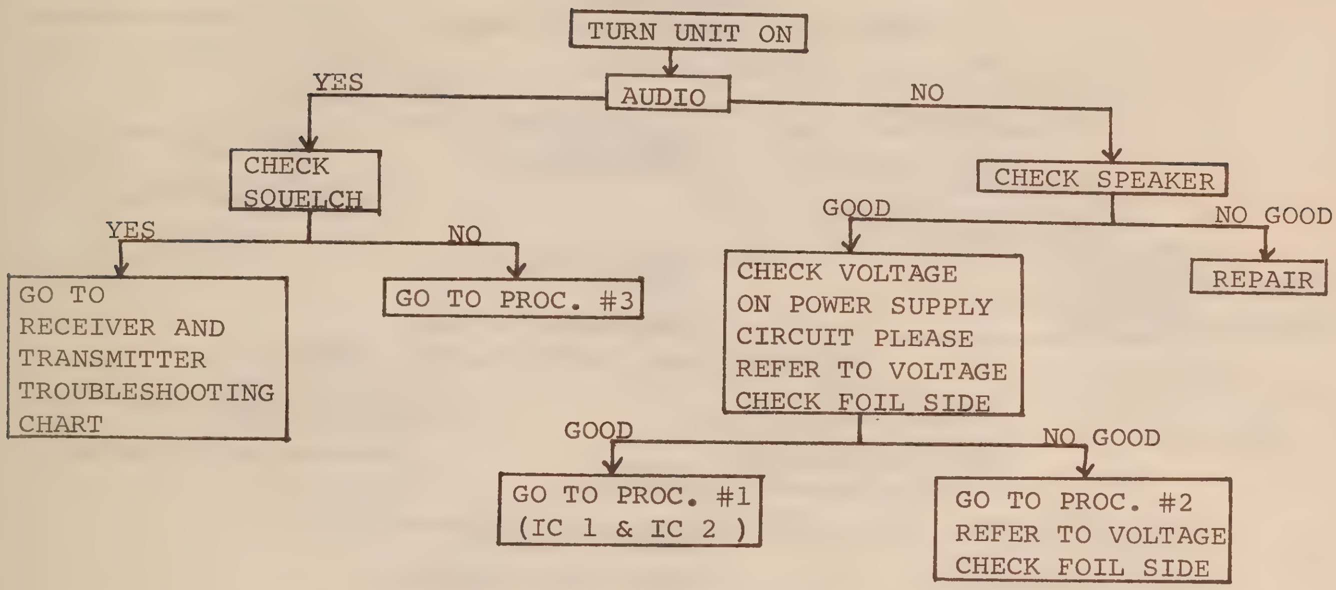
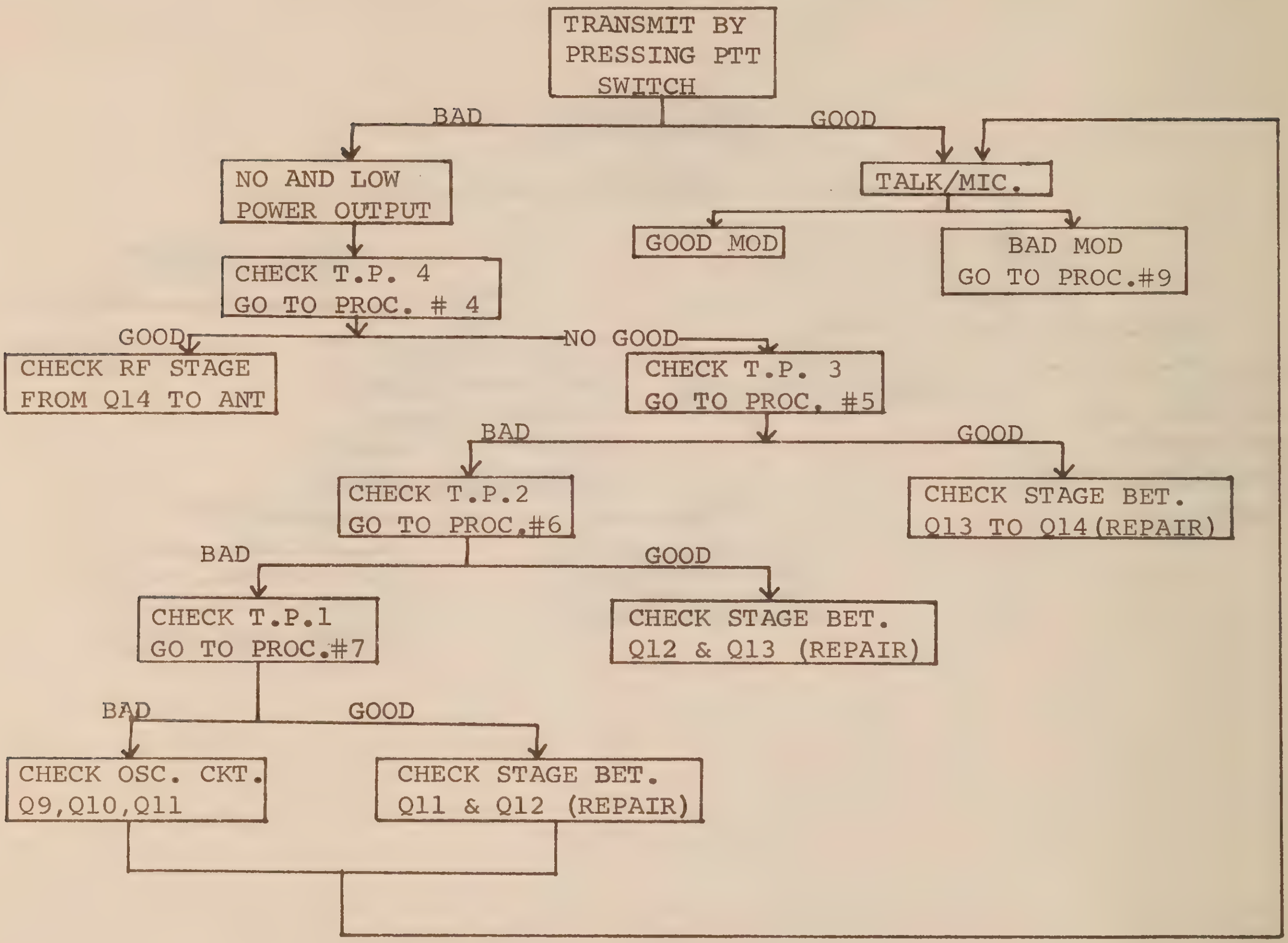
SERVICE BULLETINS

80-174(W)	MCH-40 Tx frequency stability due to voltage variations.
80-175(W)	MCU-30, 30II Transient frequency shift when Tx is keyed.
80-176(G)	MCH-40 PA Parts changes for improved quality.
80-177(W)	P1412 DC Power Supply Definition of circuit changes
80-178(W)	MA-116 Tone Board, P.C. Board 504-046 Rev. "C" only. Low Rx Sensitivity after Tx is keyed.
80-179(W)	BTH-201B W/MA-116, Board 504-046 Rev. "C" and later. No Encode tone when Tx is keyed.
80-180(G)	XLH-252 Self quieting spur frequencies
80-181(G)	XLH-252 Failure of synthesizer (IC511) during normal operation.
80-182(G)	XLH-252 Excessive low frequency deviation of carrier on transmit when radio is near Tx antenna.
80-183(W)	MCU, MCH, MCL Problems when using MA-127, 128, or 129
80-184(G)	XLH-252 Microprocessor failure due to static electricity in low humidity conditions.
80-185(G)	XLH-252 Prior to serial #2147 Transmitter problems when a supply line choke is used.
80-186(G)	XLH-252 Excessive Tx delay when supply line choke is used.
80-187(G)	MCH-40 Mechanical and Hardware Parts List
80-188(W)	P1412 Power Supply Definition of circuit changes

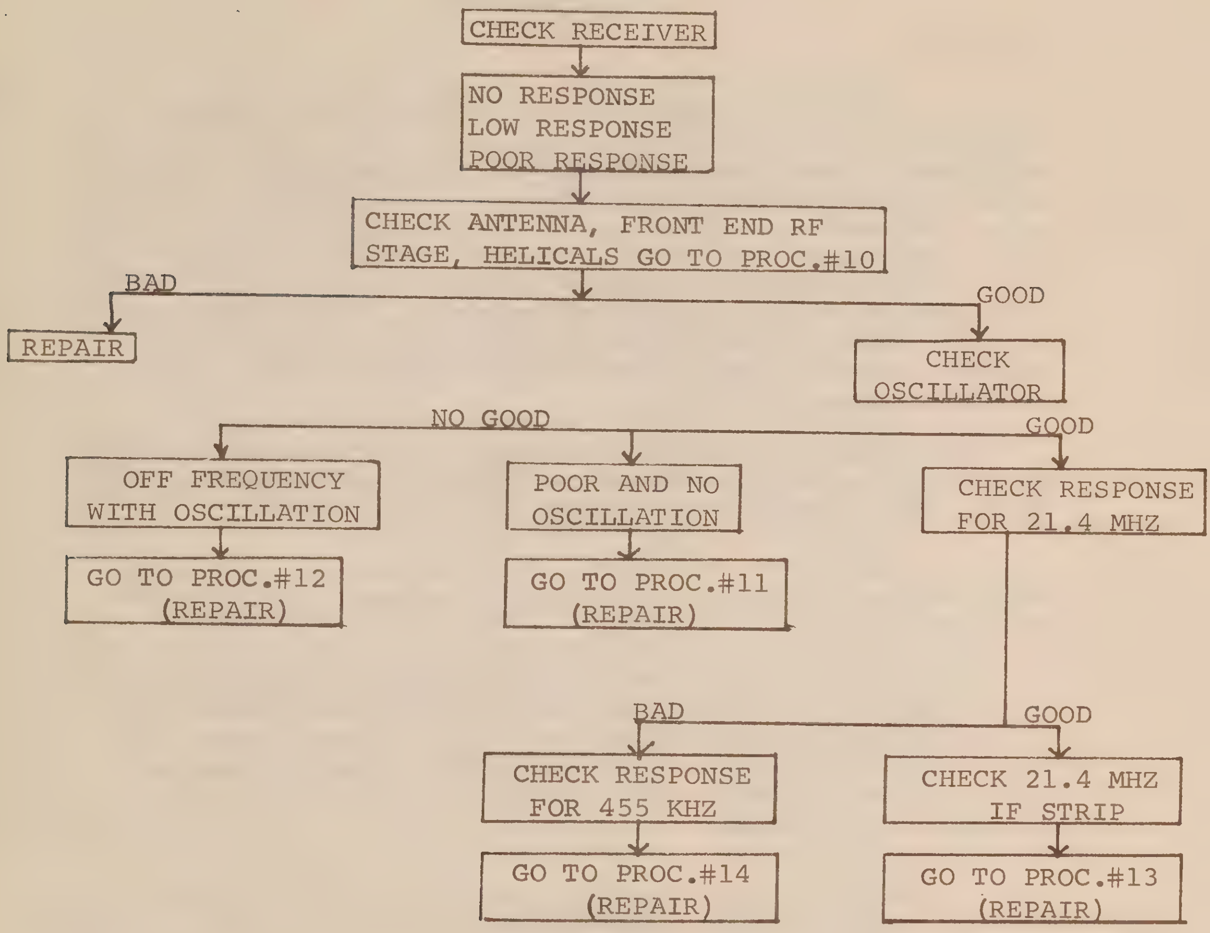
UHF TROUBLESHOOTING GUIDE


TURN UNIT ON
AUDIO
YES
NO
CHECK SQUELCH
YES
NO
GO TO RECEIVER AND TRANSMITTER TROUBLESHOOTING CHART
GO TO PROC. #3
CHECK SPEAKER
GOOD
NO GOOD
REPAIR
CHECK VOLTAGE ON POWER SUPPLY CIRCUIT PLEASE REFER TO VOLTAGE CHECK FOIL SIDE
GOOD
NO GOOD
GO TO PROC. #1 (IC 1 & IC 2)
GO TO PROC. #2 REFER TO VOLTAGE CHECK FOIL SIDE

UHF TRANSMITTER TROUBLESHOOTING CHART


TRANSMIT BY PRESSING PTT SWITCH
BAD
GOOD
NO AND LOW POWER OUTPUT
TALK/MIC.
GOOD MOD
BAD MOD GO TO PROC.#9
CHECK T.P. 4 GO TO PROC. # 4
GOOD
NO GOOD
CHECK RF STAGE FROM Q14 TO ANT
CHECK T.P. 3 GO TO PROC. #5
BAD
GOOD
CHECK T.P.2 GO TO PROC.#6
CHECK STAGE BET. Q13 TO Q14 (REPAIR)
BAD
GOOD
CHECK T.P.1 GO TO PROC.#7
CHECK STAGE BET. Q12 & Q13 (REPAIR)
BAD
GOOD
CHECK OSC. CKT. Q9,Q10,Q11
CHECK STAGE BET. Q11 & Q12 (REPAIR)

UHF RECEIVER TROUBLESHOOTING CHART


CHECK RECEIVER
NO RESPONSE
LOW RESPONSE
POOR RESPONSE
CHECK ANTENNA, FRONT END RF STAGE, HELICALS GO TO PROC.#10
BAD
GOOD
REPAIR
CHECK OSCILLATOR
NO GOOD
GOOD
OFF FREQUENCY WITH OSCILLATION
POOR AND NO OSCILLATION
CHECK RESPONSE FOR 21.4 MHZ
GO TO PROC.#12 (REPAIR)
GO TO PROC.#11 (REPAIR)
BAD
GOOD
CHECK RESPONSE FOR 455 KHZ
CHECK 21.4 MHZ IF STRIP
GO TO PROC.#14 (REPAIR)
GO TO PROC.#13 (REPAIR)

PROCEDURE 1.

NO AUDIO

A. Check the supply circuit base on UHF voltage reference and if found good, check volume control switch, adjusting clockwise give supply to the receiver stage and audio circuit. Check also the squelch control if it is at a minimum or off position. If the squelch control is set to maximum, the audio is totally dead, pin #13 of IC1 is zero voltage, squelch switch transistor Q4 and Q5 will not function also and no power to supply the audio section (IC2). Voltage check and resistance check are recommended for better detection on audio stage. Refer to UHF voltage reference.

B. Check the wiring from the input of audio section to volume control and from the volume control to the output of the receiver section (Speaker).

C. Check pin #9 of IC1 if it is shorted to ground, this causes no audio, although all voltage on the audio section is okay.

D. Inject 1KHz audio signal from audio generator at the input of IC2 pin #2 (LM386N), volume control and pin #9 of IC1 to make sure that all coupling components are okay. This procedure also helps to detect whether IC2 is good or bad by just looking at the signal waveform on the oscilloscope.

PROCEDURE 2.

POWER SUPPLY CIRCUIT (SEE UHF VOLTAGE REFERENCE)

RECEIVER SWITCHING TRANSISTOR

The output of Q8 is regulated at about 8 volts. When PTT is pressed to transmit the receiver switching transistor is grounded, turning off the entire receiver section.

NOTE: When checking any transistor (Q) always check for the possible hanging; defective components around it.

PROCEDURE 3.

WITH AUDIO BUT SQUELCH NOT FUNCTIONING

Check Pin #10 of IC1 if shorted to ground. Pin #3 of the same IC should be 1.8 volts approximately when the squelch control is off position, adjusting the squelch control clockwise, pin #13 of IC1 will be zero, meaning squelch switch of IC1 is functioning. Check resistor R16 (220K) this usually broken or open. Check resistor R14 (10K) might be shorted to resistor R15 (10K) at the diode foil or possibly broken.

Check switching transistor Q4 and Q5 it might be leaky that the audio circuit is always on. Check also the continuity of the black wire connected on pin #13 of IC1 to R30 which is connected to the base of Q5. If black wire is open or hanging, squelch switch will not function.

Perform continuity test on two conductor cable. Also check if any of the conductor is shorted to ground this affect the squelch and circuit.

PROCEDURE 4.

CHECK T.P. 4

Connect a voltmeter set for 0-2V range to TP4. Reading obtained should be approximately 1.5V +30%. When obtained reading is low, adjust T16 and T17. If nothing happens go to TP3 for a check.

PROCEDURE 5.

If TP3 checks to be okay, problem lies between stage of Q13 and Q14. Check all bypass and coupling capacitor, transformer and two transistors. However, when low or no TP3 is observed proceed to TP2 for further troubleshooting.

PROCEDURE 6.

Measure TP2 using 0-2 volt range voltmeter. Reading should be near the value of voltage specified or the voltage reference. If reading obtained is normal, problem lies between Q12 and Q13 stage. Check both transistors, coupling capacitor, transformer and bypass capacitor on that stage. When TP2 does not exist go to TP1.

PROCEDURE 7.

Connect a voltmeter to TP1 set for 0-.5V range, tune T12 for a dip (Minimum), voltmeter reading should be approximately 0.3V. If no dip or voltage observed the oscillator circuit is dead. Check voltages of Q9, Q10, and Q11 referring to the voltage reference provided. If voltage is normal, check stage bet. Q11 and Q12, also check the transmit crystal or its connection on the radio (see if it is on the right channel)

PROCEDURE 8.

Connect a voltmeter to TP5 making sure that TP5 is properly adjusted. Tune TC9, TC10, T16, and T17 for maximum reading TP5 around 0.25V. If no or low reading is observed Q15 or any of the coupling capacitor is bad, it may also be R60 shorting to ground. But if reading reaches to about 0.4 volt or more, R60 is probably open. Verify these by using an ohmmeter across R60. If spectrum analyzer is readily available set it for 100 MHz/division. 3MHz resolution and the input attenuator to its proper level. With the PTT switch keyed, start tracing your signal at the collector of Q14 going back to the antenna. At the point where signal is lost or suffered a great loss the preceeding stage is at fault.

SPURIOUS EMISSION

Spurious omission is also one problem of the radio. If spectrum analyzer is available and the spurious emission is about 10 db below carrier, check voltage on D4, PTT is keyed it should have a reading of 0.8 volt, if voltage is high, D4 is probably open. Check D4 and R65 by resistance check. If no voltage attain D4 is probably shorted to ground or Tx supply for D4 is open. If voltage at D4 is okay, check base emitter resistance of Q17 for short.

If spurious emission is about 30 db below carrier, check TP5, if found low adjust T16 and R17, TC9, TC10. If TP5 is normal, check TC11, R62, and R86. If all the preceeding steps were made and spurious problem still remains, check Q14 and Q17 by resistance check.

PROCEDURE 9.

BAD MODULATION

Bad modulation can be checked by signal tracing using an oscilloscope and audio generator of 1 KHz/ 10MV peak to peak amplitude. Tracing starts from the microphone input to microphone amplifier, limiter, integrator buffer and filter. When the signal is lsot or becomes distorted, the problem lies on that stage. Refer to the foil side tracing points and the corresponding waveform pattern provided for this test.

PROCEDURE 10.

ANTENNA, FRONT END (HELICALS)

Using an RF probe with a 5PF capacitor in series, start injecting your (fo) operating frequency, from the antenna going to the base of Q2. This implies using signal injection method in isolating the bad stage in the RF section, with the aid of signal injection guide provided for. When passing through each component, no great loss in the signal strength should be suffered (not more than 10 db). If in case signal is lost after passing through each component the fault lies on that area where signal was lost. Measure the voltage supply for both Q1 and Q2 and perform resistance test to determine the bad component. Also watch for an abnormal tuning of the helical, this is an indication of a bad helical or the component arount it.

PROCEDURE 11.

OSCILLATOR

A. Poor And No Oscillation.

Connect a voltmeter to TP6 and receiver crystal on its proper channel and tune T9 for minimum deflection (dip) of the voltmeter approximately 2 volt. If the said reading is not reached, the oscillator is not working normally, look for open transformer, defective transistor and hanging components.

PROCEDURE 12.

OFF FREQUENCY WITH OSCILLATION

If reading of about 2 volts is available at TP6 and still no receiver response, adjust the frequency setting of the signal generator above or below carrier frequency using 1 KHz increment. This problem is often due to defective or hanging capacitor in the oscillator circuit and sometimes bad transistor on the same stage.

PROCEDURE 13.

21.4 MHz RESPONSE

Using a .01 uf probe inject 21.4 MHz signal at the base of Q2. If no signal is received or signal display is distorted, start injecting the 21.4 MHz signal at pin 16 of IC1 going back to Q2. If signal loss is significant or becomes distorted when passing through each component, a comparison can be made on reading obtained with the signal injection guide provided. Measure supply voltage at specified points and check resistance of components where the signal is lost.

PROCEDURE 14.

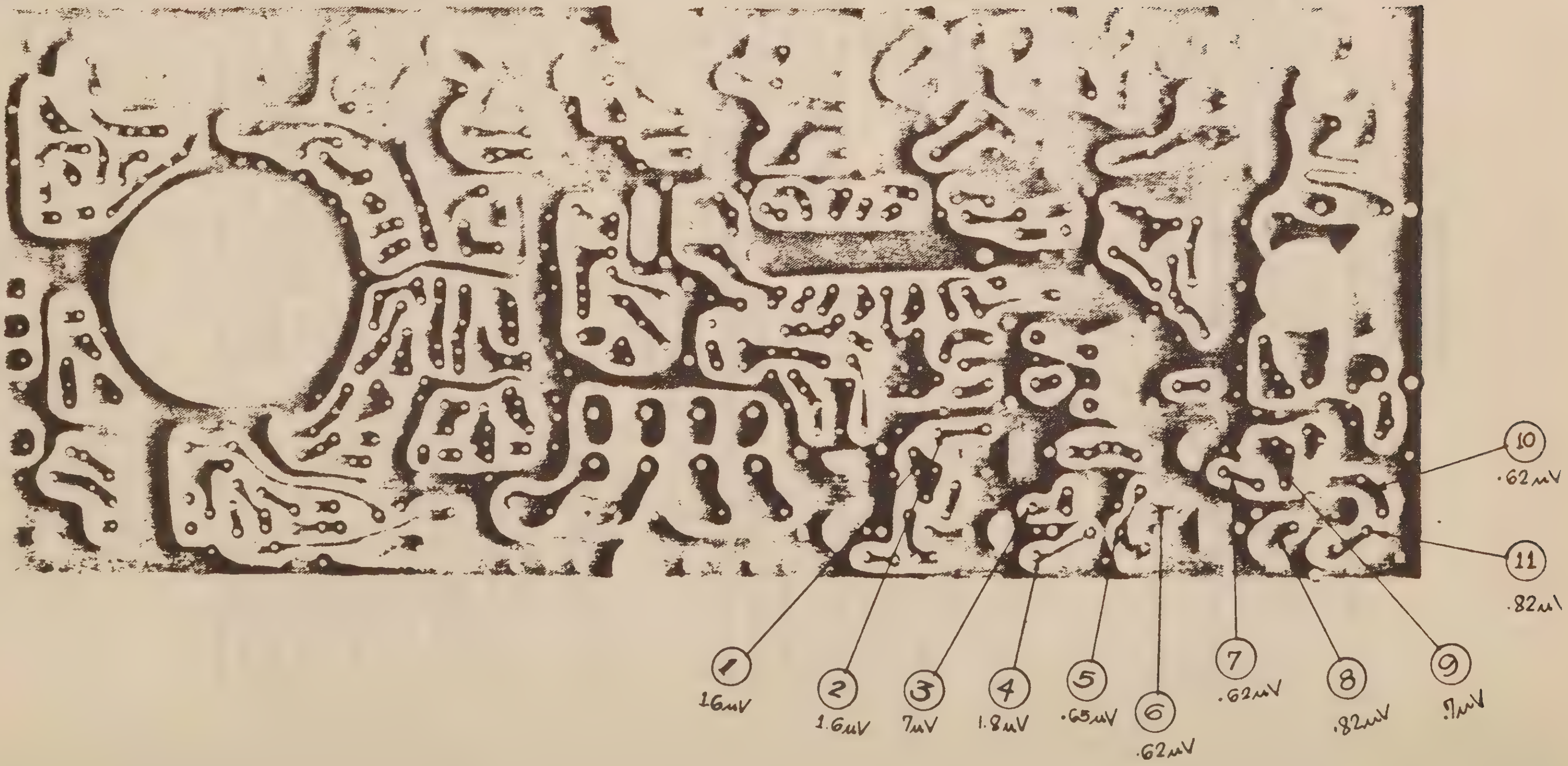
455 KHZ RESPONSE

The same procedure like the above could be applied for these tests. Using 455 KHz signal injected at pin #3 to pin #1 of IC1. Reading should be near the value indicated of the signal injection guide. If signal at pin #1 is applied and no signal display appears on the scope, increase the FM signal generator output until the receiver produces a clean sinewave. If at this point there is still no response, try tapping a new 20.945 MHz crystal and observe if it cures the problem. Also, check for hanging components such as capacitors and resistors. When all the foregoing procedure has been made and still there is no response, the only suspicious component left is IC1.

F0 REFERENCE SIGNAL INJECTION LEVEL

repared By: ate :	Part No:	Rev.	Labor Code:	Description :

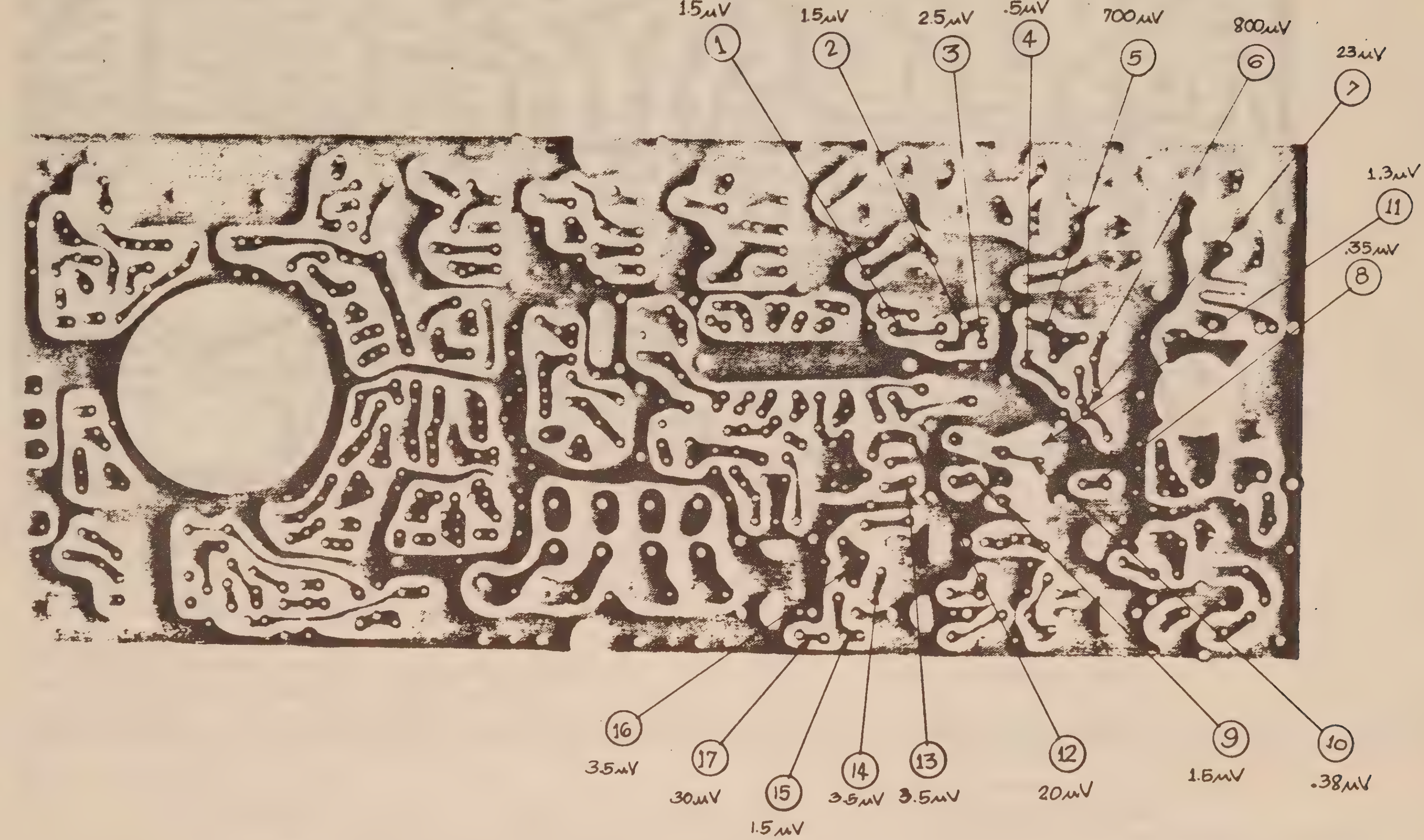
Readings were taken using 5pf test probe at 12 dB sinadder.



① 16uV
② 1.6uV
③ 7uV
④ 1.8uV
⑤ .65uV
⑥ .62uV
⑦ .62uV
⑧ .82uV
⑨ .7uV
⑩ .62uV
⑪ .82uV

	OPERATION DESCRIPTION 21.4MHZ REFERENCE SIGNAL INJECTION LEVEL		PRN. CODE:	PAGE :
Prepared By: Date :	Part No:	Rev.	Labor Code:	Description :

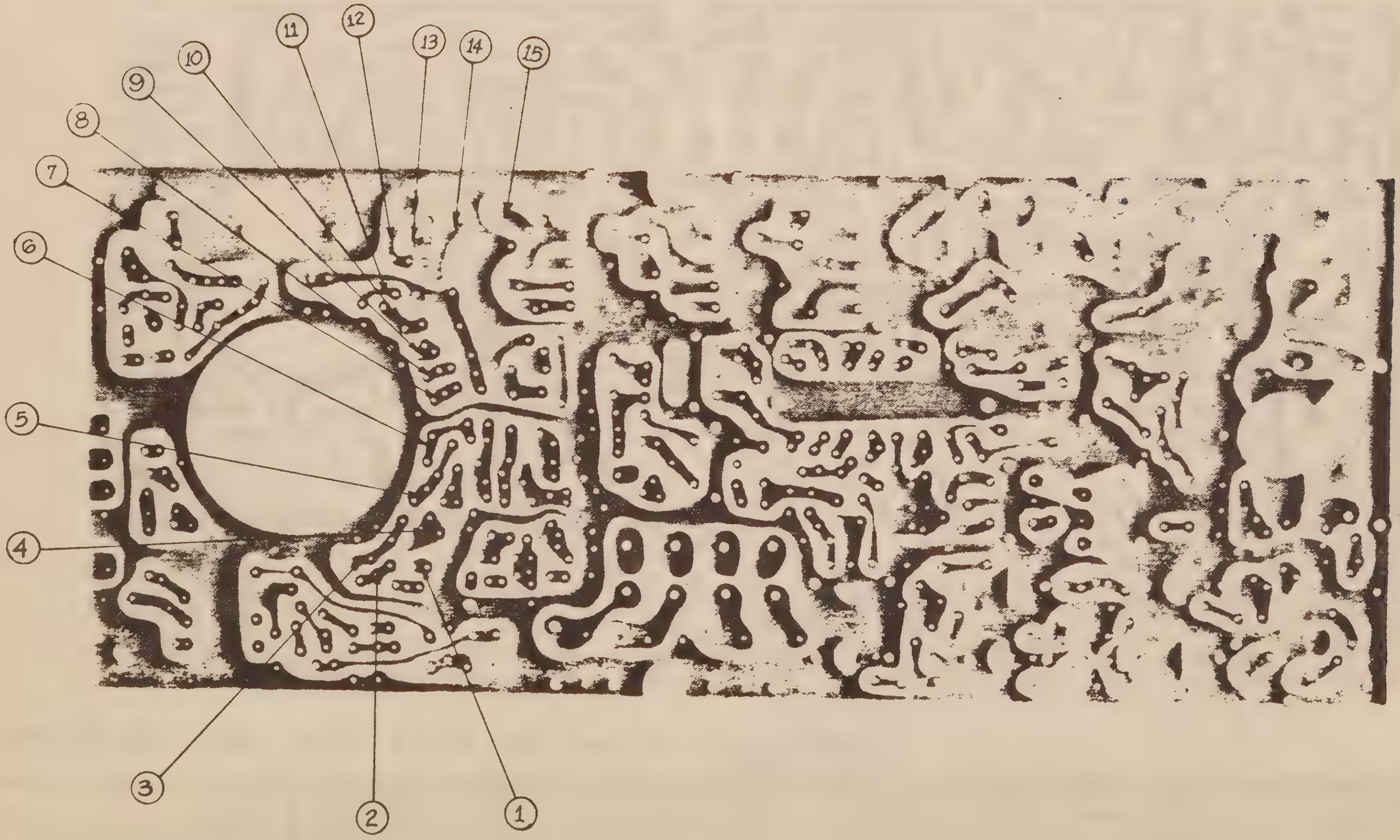
Readings were taken using 0.01 uf test probe at 12 dB sinadder.



① 1.5µV
② 1.5µV
③ 2.5µV
④ .5µV
⑤ 700µV
⑥ 800µV
⑦ 23µV
⑪ 1.3µV
⑧ .35µV
⑯ 3.5µV
⑰ 30µV
⑮ 1.5µV
⑭ 3.5µV
⑬ 3.5µV
⑫ 20µV
⑨ 1.5µV
⑩ .38µV

OPERATION DESCRIPTION UHF MODULATION TEST POINTS			OPN. CODE:	PAGE #
Part No:	Rev.	Labor Code:	Description :	

repared By:
ate :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OPERATION DESCRIPTION
UHF FOIL SIDL VOLTAGE REFERENCE

OPN. CODE:

PAGE :

Prepared By:

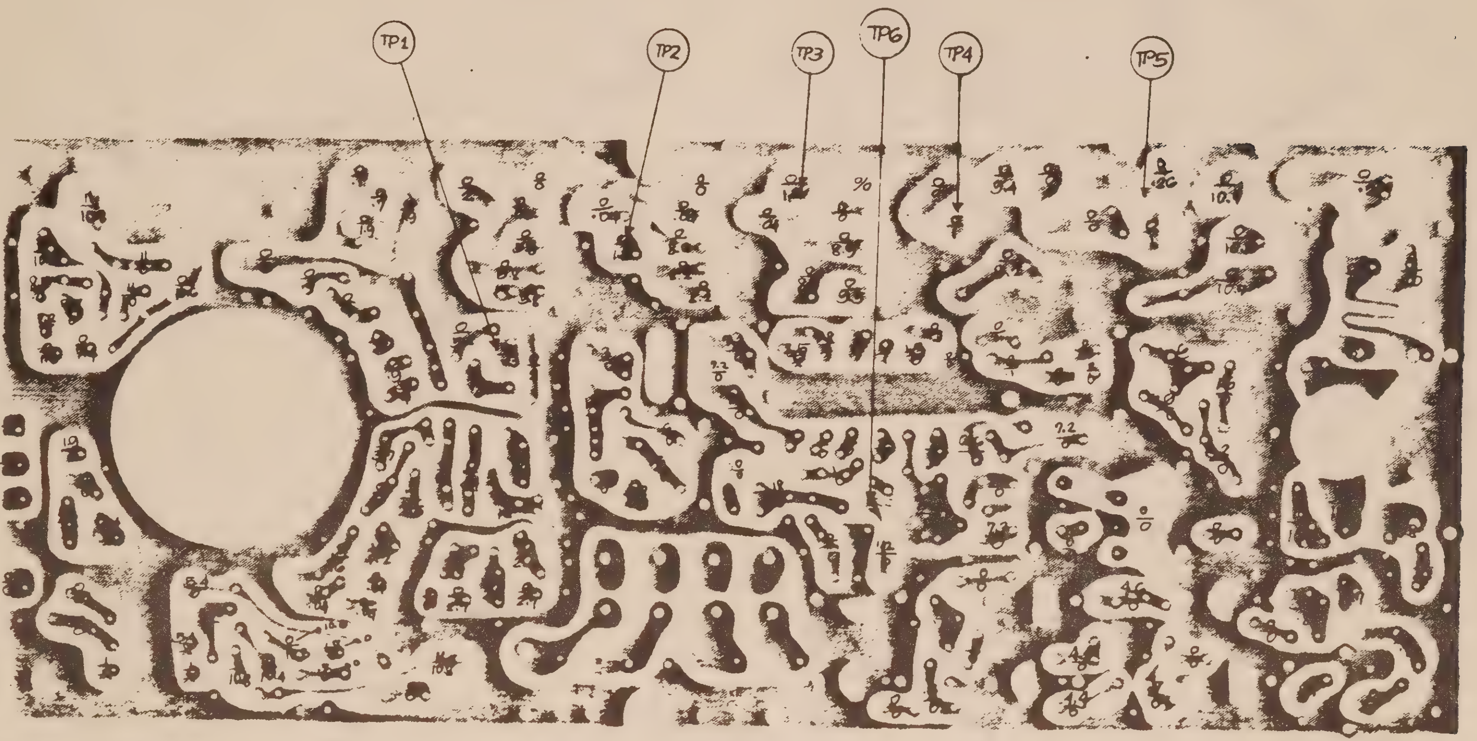
Date :

Part No:

Rev.

Labor Code:

Description :



* INDICATES DC VOLTAGE TENDS TO DECREASES SLOWLY
→ INDICATES VOLTAGE TO CHANGE DURING SQUELCH

VOLTAGES WERE OBTAINED ON 10 UHF GOOD RADIOS WITH CRYSTAL (AVE.)

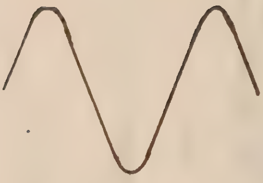
$\frac{RX}{TX}$

TEST EQUIPMENT USE:

1. VTVM
   HEATH SCHLUMBERGER
   MODEL SM 5228
2. POWER SUPPLY
   applying 11 volts DC
   after D12.

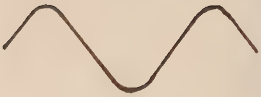
UHF MODULATOR SIGNAL WAVEFORM

①



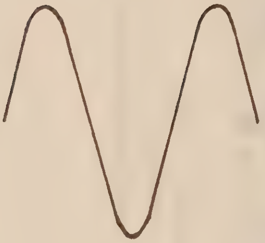
10 mvolts

②&③



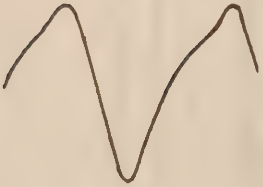
4 mvolts

④



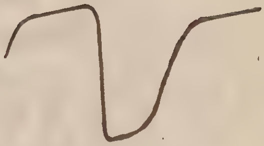
.19 volt

⑤



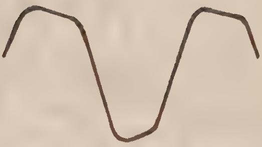
.165 volt

⑥



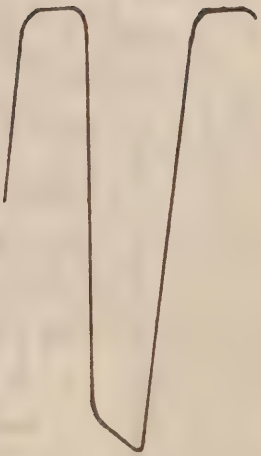
.85 volt

⑦&⑧



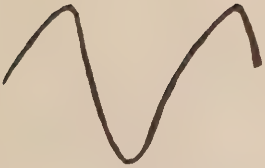
.8 volt

⑨



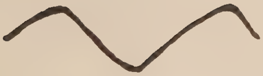
.32 volt

⑩



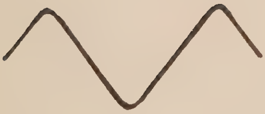
.46 volt

⑪ & ⑫



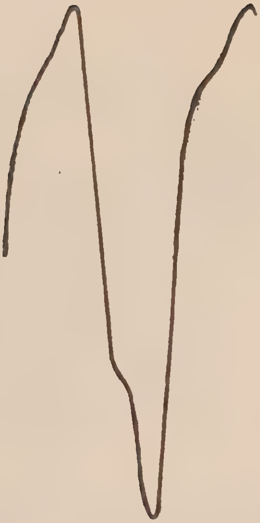
.35 mvolts

⑬



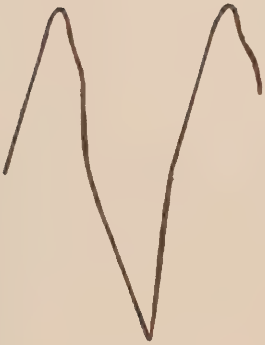
.45 volt

⑭



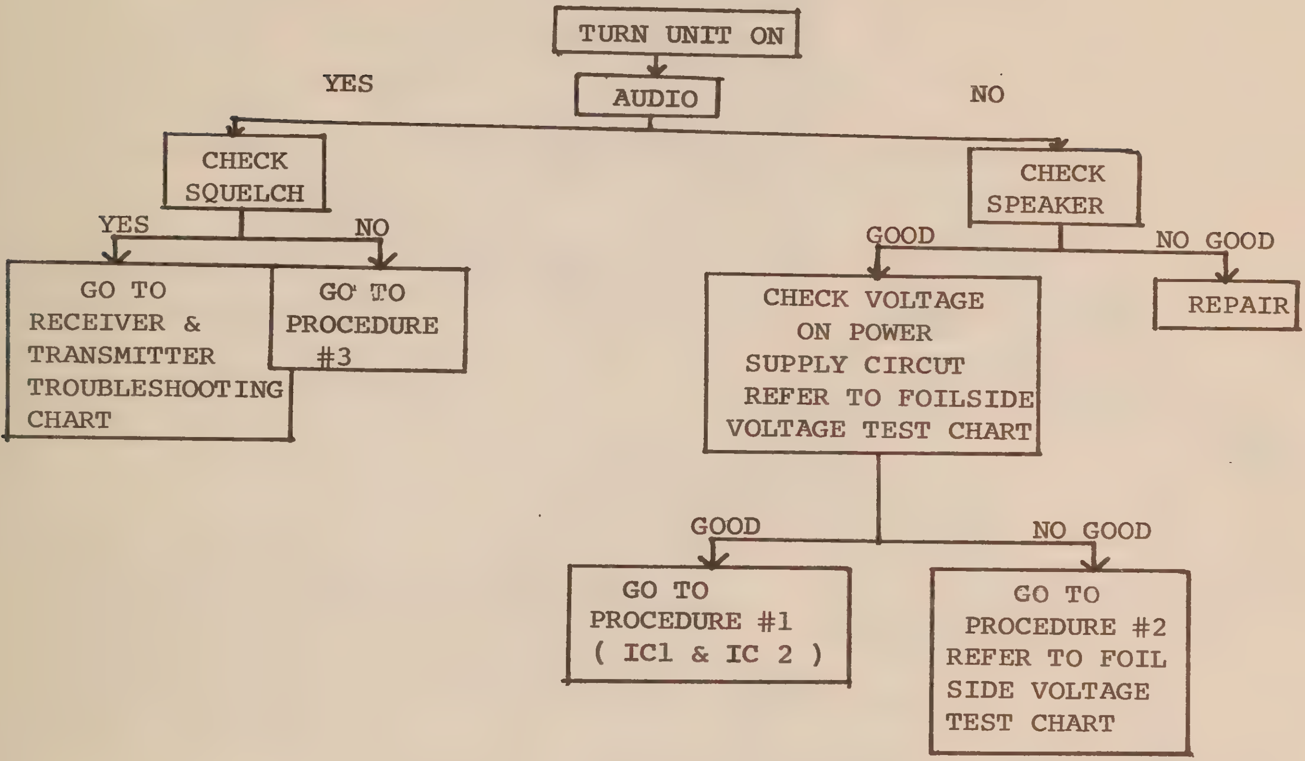
.35 mvolts

⑮

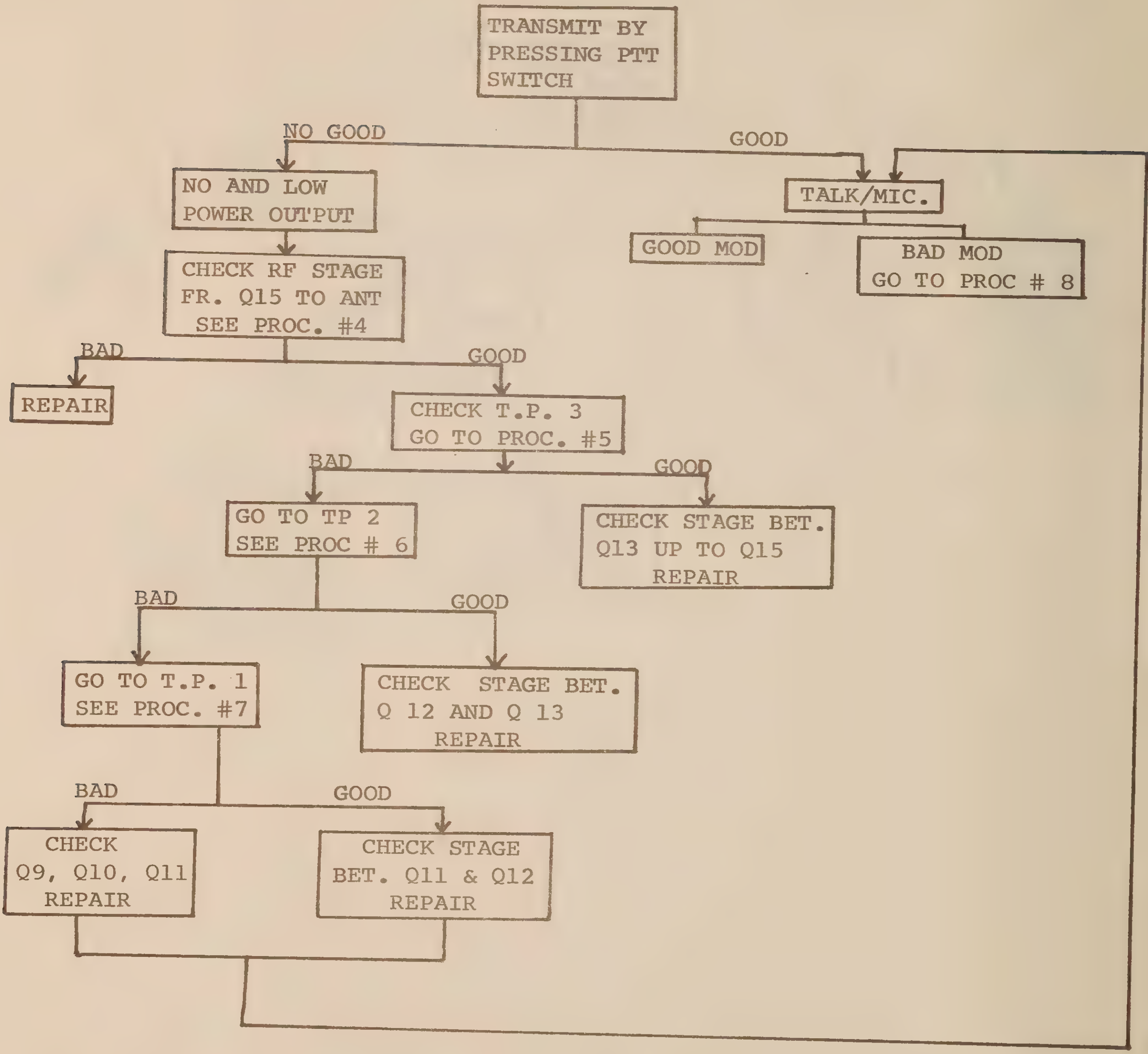


.25 mvolts

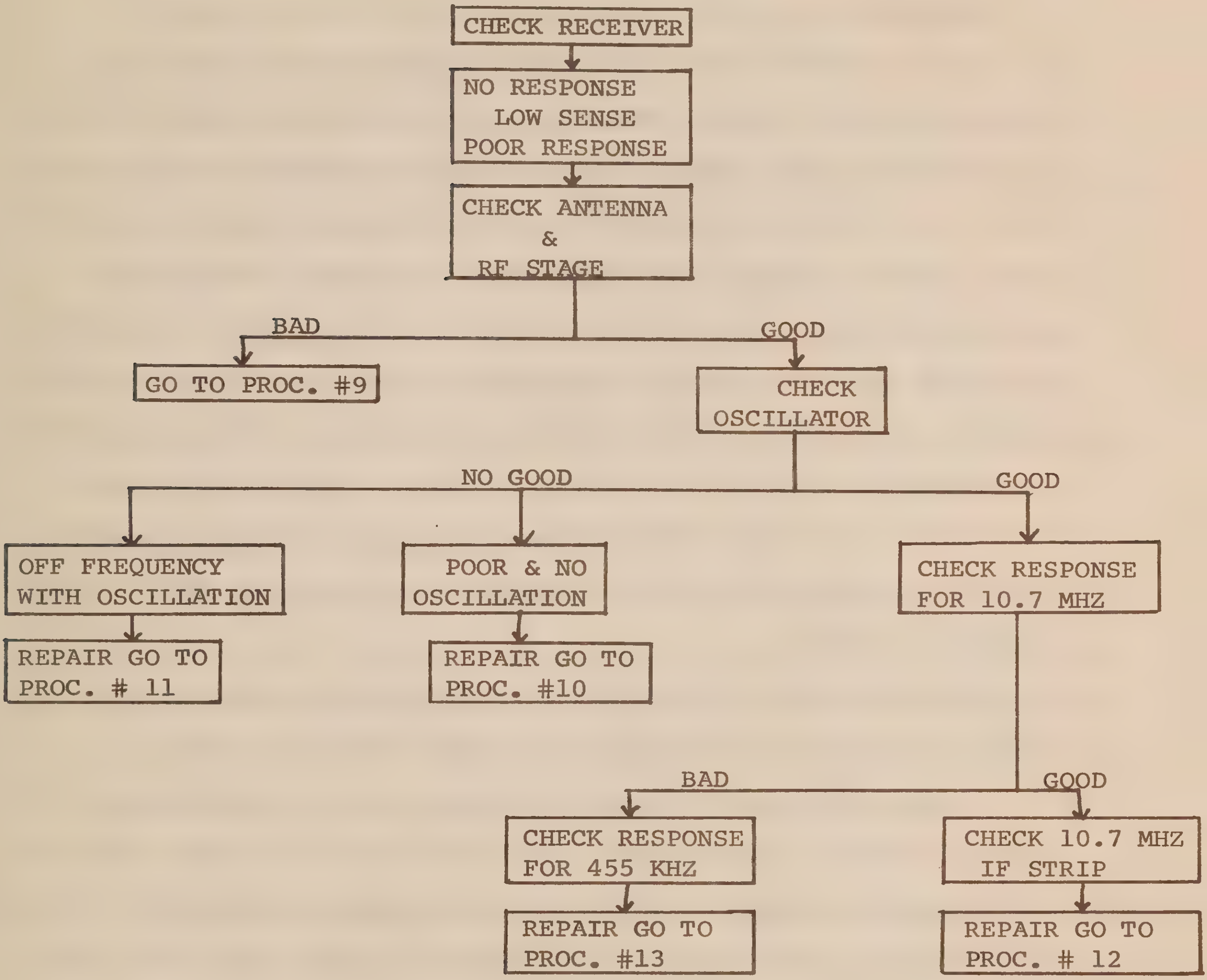
VHF TROUBLESHOOTING GUIDE


TURN UNIT ON
AUDIO
YES
NO
CHECK SQUELCH
YES
NO
GO TO RECEIVER & TRANSMITTER TROUBLESHOOTING CHART
GO TO PROCEDURE #3
CHECK SPEAKER
GOOD
NO GOOD
CHECK VOLTAGE ON POWER SUPPLY CIRCUT REFER TO FOILSIDE VOLTAGE TEST CHART
REPAIR
GOOD
NO GOOD
GO TO PROCEDURE #1 (IC1 & IC 2)
GO TO PROCEDURE #2 REFER TO FOIL SIDE VOLTAGE TEST CHART

VHF TRANSMITTER TROUBLESHOOTING CHART


TRANSMIT BY PRESSING PTT SWITCH
NO GOOD
GOOD
NO AND LOW POWER OUTPUT
TALK/MIC.
GOOD MOD
BAD MOD GO TO PROC # 8
CHECK RF STAGE FR. Q15 TO ANT SEE PROC. #4
BAD
GOOD
REPAIR
CHECK T.P. 3 GO TO PROC. #5
BAD
GOOD
GO TO TP 2 SEE PROC # 6
CHECK STAGE BET. Q13 UP TO Q15 REPAIR
BAD
GOOD
GO TO T.P. 1 SEE PROC. #7
CHECK STAGE BET. Q 12 AND Q 13 REPAIR
BAD
GOOD
CHECK Q9, Q10, Q11 REPAIR
CHECK STAGE BET. Q11 & Q12 REPAIR

VHF RECEIVER TROUBLESHOOTING CHART


CHECK RECEIVER
NO RESPONSE LOW SENSE POOR RESPONSE
CHECK ANTENNA & RF STAGE
BAD
GOOD
GO TO PROC. #9
CHECK OSCILLATOR
NO GOOD
GOOD
OFF FREQUENCY WITH OSCILLATION
REPAIR GO TO PROC. # 11
POOR & NO OSCILLATION
REPAIR GO TO PROC. #10
CHECK RESPONSE FOR 10.7 MHZ
BAD
GOOD
CHECK RESPONSE FOR 455 KHZ
REPAIR GO TO PROC. #13
CHECK 10.7 MHZ IF STRIP
REPAIR GO TO PROC. # 12

PROCEDURE 1.

NO AUDIO

a. After checking the power supply circuit on foil side voltage check and found it good, check volume control switch, adjusting clockwise give supply to the receiver stage and audio circuit. Check also the squelch control if it is at a minimum or off position. Of the squelch control is set to maximum, the audio is totally dead, pin #13 of IC1 is zero voltage, squelch transistor Q7 and Q8 will not function also and no power to supply the audio section (no receive) (IC2) voltage check and resistance check are recommended for better detection. See foil side voltage check.

b. Check the wiring from the input of audio section to volume control and from the volume control to the output of the receiver section (speaker)

c. Check pin #9 Of IC1 if is shorted to ground, this causes no audio, although all voltage on the audio section is okay.

d. Inject 1KHZ audio signal from sudio gen. at the input of IC2 pin #2 (LM386N), volume control and pin 9 of IC1 to make sure that all coupling component are okay. This procedure also help to detect whether IC2 is good or bad, just looking at the signal wave form on the oscilloscope.

PROCEDURE 2

POWER SUPPLY CIRCUIT: (See foil side voltage check)

RECEIVER SWITCHING TRANSISTOR

The output of Q6 is regulated at about 8 volts. When PTT is pressed to transmit, the receiver switching transistor is grounded, turning off the entire receiver section.

Q19 which is the transmitter switching transistor turns on and supplies voltage to all transmitter stages. This includes the deviation circuit, the multiplier and driver of the transmitter circuit. B^+ is always present at the final transistor, regardless of the mode of the radio.

A. RADIO ALWAYS ON TRANSMIT MODE

We can easily determine if the radio is on the transmit mode, the LED always lights on, check the PTT switch if it is defective, check components around PTT, sometimes it touches to terminal of the PTT switch that causes the radio to be on transmit mode. Pin #2 and pin #3 of the female jack (J3) might be shorted.

B. LED never lights ON although the transmitter switching transistor is good. Check the zener diode (D9) connected from the collector of the tx transistor, check also the resistor connected to the zener diode.

C. Defective Transmitter switching transistor (Q19)

If some parts of the transmitter stage become shorted to ground, especially the B+ the transmitter switching transistor in the first one to be affected, this transistor acts like a fuse, if any high current or overload due to shorted B+, the transmitter switching transistor will burn-out or it become leaky, this also affect the receiver section. The receiver switching transistor

CONT. OF PROCEDURE 2

(Q6) will disable the audio amplifier and cause no received.

CONSULT THE PCN FOIL SIDE FOR VOLTAGE CHECK

Note: When checking any Q(transistor) always check for the possible hanging, defective components around it.

PROCEDURE 3

WITH AUDIO BUT SQUELCH NOT FUNCTIONING

Check PIN No. 10 of IC1 if shorted to ground, pin #13 should be 1.8 volts approximately when the squelch control is at off position, adjusting the squelch control clockwise, PIN #3 of IC1 will be zero, meaning squelch switch of the IC1 is functioning. Check resistor R12, this is usually broken or open. Check resistor R10 (10K) might be shorted to resistor R11 (10K) at the diode foil or possibly broken.

Check switching transistor Q7 and Q8 it might be leaky that the audio circuit is always on. Check also the continuity of the black wire connected on pin #13 of IC1 to R20 which is connected to the base of Q7. Of black wire is open or hanging squelch switch will not function.

Perform continuity test on two conductor cable. Also check if any of two conductor is shorted to ground this affect the squelch and audio circuit.

R9 (220K) also affect the squelch circuit perform resistance check, check if it is shorted to ground.

PROCEDURE 4.

NO AND LOW POWER OUTPUT

By tuning TC13, the current reading should increase to 500MA or more and power should be indicated on the wattmeter. If no power is observed the problem lies on the circuitry following Q15. Check for short or defective capacitor. From collector of Q15 all the way up to antenna.

If tuning TC13, the current does not increase, checked the supply voltage of Q15 and Q14. In addition performed resistance check for the two transistor repectively for possible short or open.

PROCEDURE 5.

If both transistor check good, connect a voltmeter at T.P.3, a reading of about 1.5 volt should be obtained, if not check Q13, coupling; by-pass capacitor; T15 and T16 by ohmmeter.

Note: It would be best if capacitor or transistor under suspect will be directly substituted.

PROCEDURE 6.

Measure T.P. 2 using 0-2volt range voltmeter, reading should be about 1.5 volt, if voltage does not exist check Q12, T13 and T14 and components in the vicinity.

PROCEDURE 7.

Check oscillator (TP1), connect a volmeter to TP1 and shunt Transmitter crystal momentarily or channel. If the voltage decreases the oscillator is working normally. When TP1 makes no variation, check B+ supply along D8 and the rest of the transistors in the oscillator circuit, refer to coltage measurement indicated on Foil Side Diagram. If a difference in reading is observed, the components within that area is on suspect.

PROCEDURE8.

BAD MODULATION:

Bad modulation can be check by signal tracing using an oscilloscope and audio generator of 1 KHZ/10MV peak to peak amplitude. From microphone input, mic amplifier, limiter, integrator buffer and filter. When the signal is lost or become distorted, the problem lies on that stage. Refer to the foil side tracing points and waveform pattern provided for this test.

PROCEDURE 9.

BAD RF STAGE

Check antenna for short and open test. Using a 0.01uf RF probe, inject the crystal frequency starting at the base of Q2 following the signal path to the antenna. Signal attenuation should not be more than 10db when going thru each components. At the points where the signal is lost conduct voltage and resistance check.

PROCEDURE 10.
OSCILLATOR

A. POOR AND NO OSCILLATION

Connect a voltmeter to TP6 and receiver crystal on its proper channel and tune T9 for minimum deflection of the voltmeter approx. 1volt. If the said reading is not reached the oscillator is not working normally, look for open transformer, defective transistor and hanging components.

PROCEDURE 11.

OFF FREQUENCY WITH OSCILLATION

If reading of about 1 volt is available at T.P4 and still to receiver response, adjust the frequency setting of the signal generator above or below carrier frequency using 1KHZ increment. This problem is often due defective or hanging capacitor in the oscillator circuit and sometimes bad transistor.

PROCEDURE 12.

10.7MHZ RESPONSE

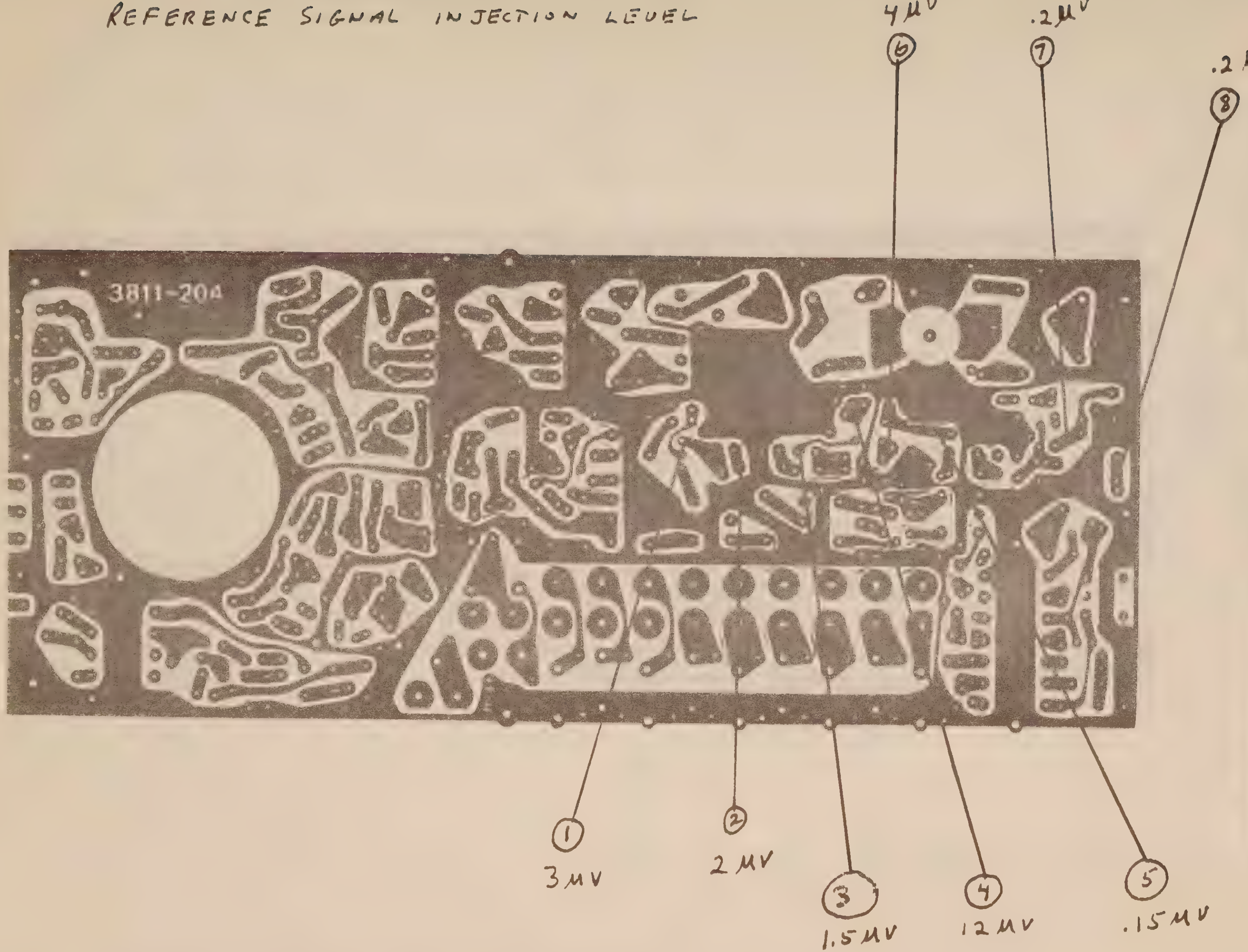
Using a .01 uf probe inject 10.7 signal at the base of Q2. If no signal is received or signal is distorted. Start injecting the 10.7 MHZ signal at pin 16 of IC1 going back to Q2. Refer to the 10.7 MHZ signal injection level for signal tracing. If signal loss is significant or becomes distorted when passing through each component, measure supply voltage at specified points; check resistance of component where the signal is lost.

PROCEDURE 13.

455KHZ RESPONSE

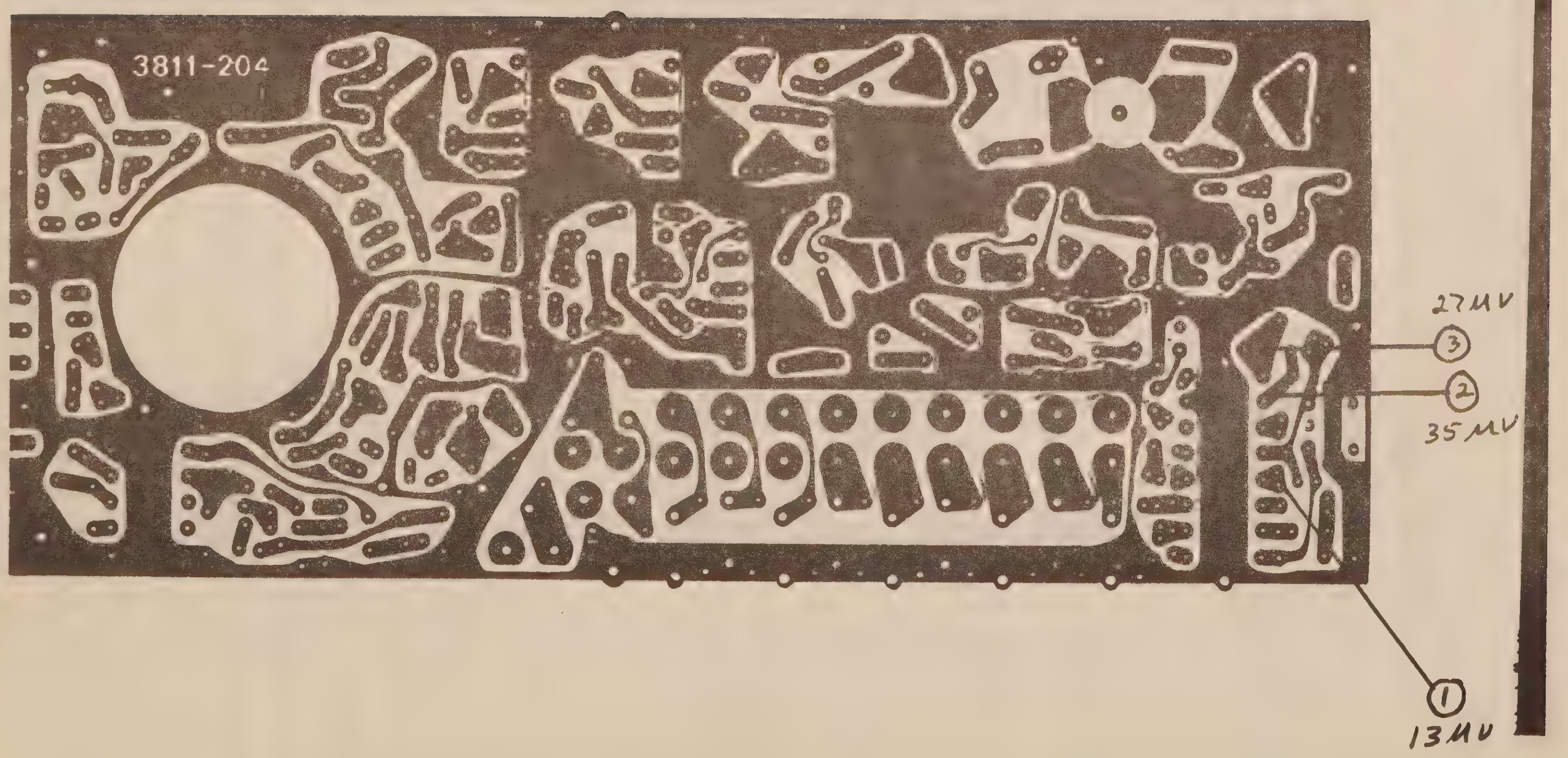
The same procedure like the above could be applied for these using 455KHZ signal starting at pin #3 to pin #1 of IC1. A reference signal injection level is provided appear on the scope. Increase the FM signal generator output till the receiver prodeces a lean sinewave. If at this point there is still no response. Try tapping a new 10.245MHZ crystal and observed if it cures the problem. Also check for hanging component such as capacitors. When all the foregoing procedure has been made and still there is no response. The only suspicious component left is IC1.

REFERENCE SIGNAL INJECTION LEVEL

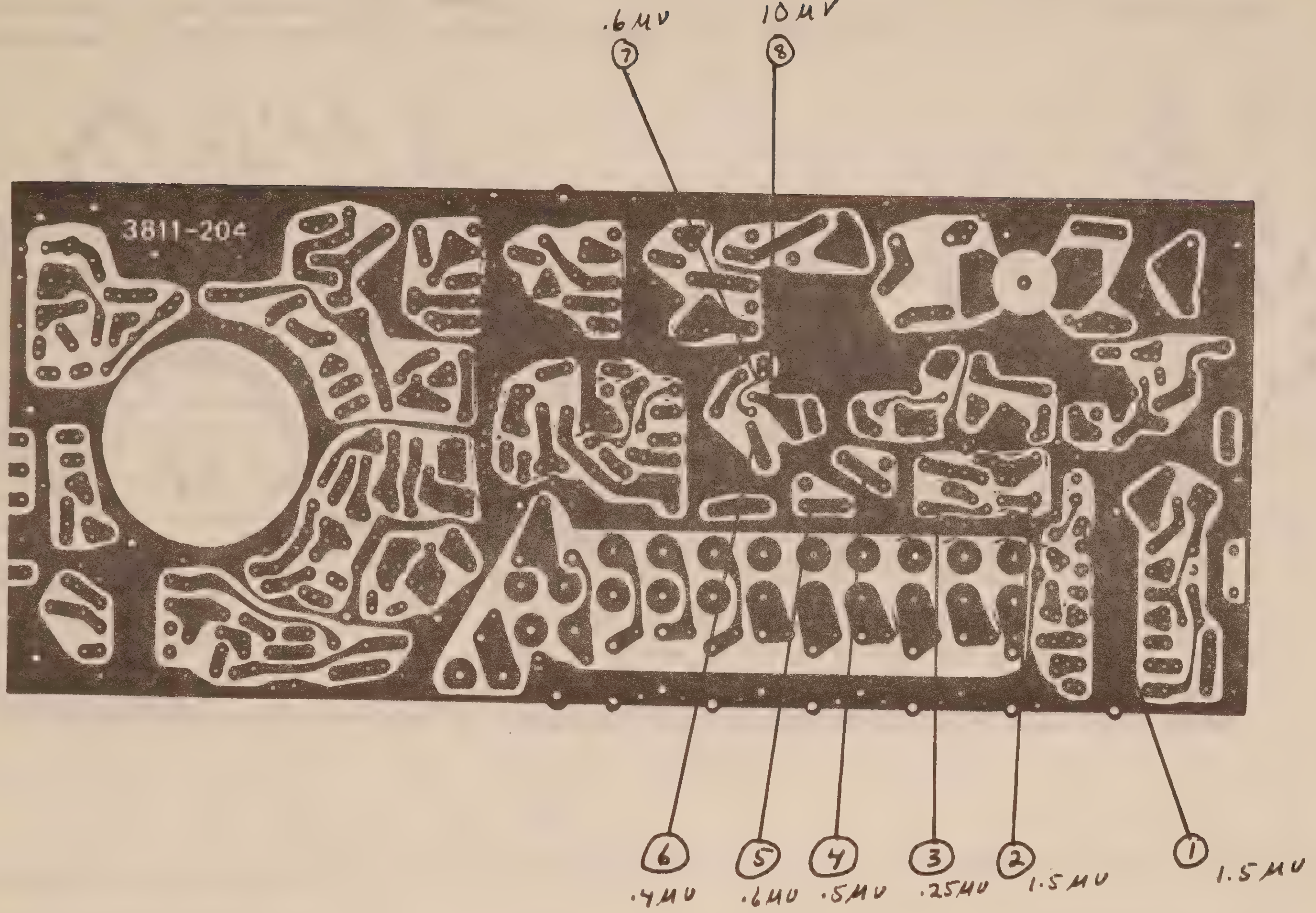


3811-204
⑥ 4μV
⑦ .2μV
⑧ .2μV
① 3μV
② 2μV
③ 1.5μV
④ 12μV
⑤ .15μV

455 KHZ SIGNAL INJECTION LEVEL


3811-204
27 MV
③
②
35 MV
①
13 MV

10.7 MHZ SIGNAL INJECTION LEVEL


.6MV
⑦
10MV
⑧
3811-204
⑥
.4MV
⑤
.6MV
④
.5MV
③
.25MV
②
1.5MV
①
1.5MV

OPERATION DESCRIPTION

VHF FOIL SIDE VOLTAGE REFERENCE

OPTN. CODE:

PAGE:

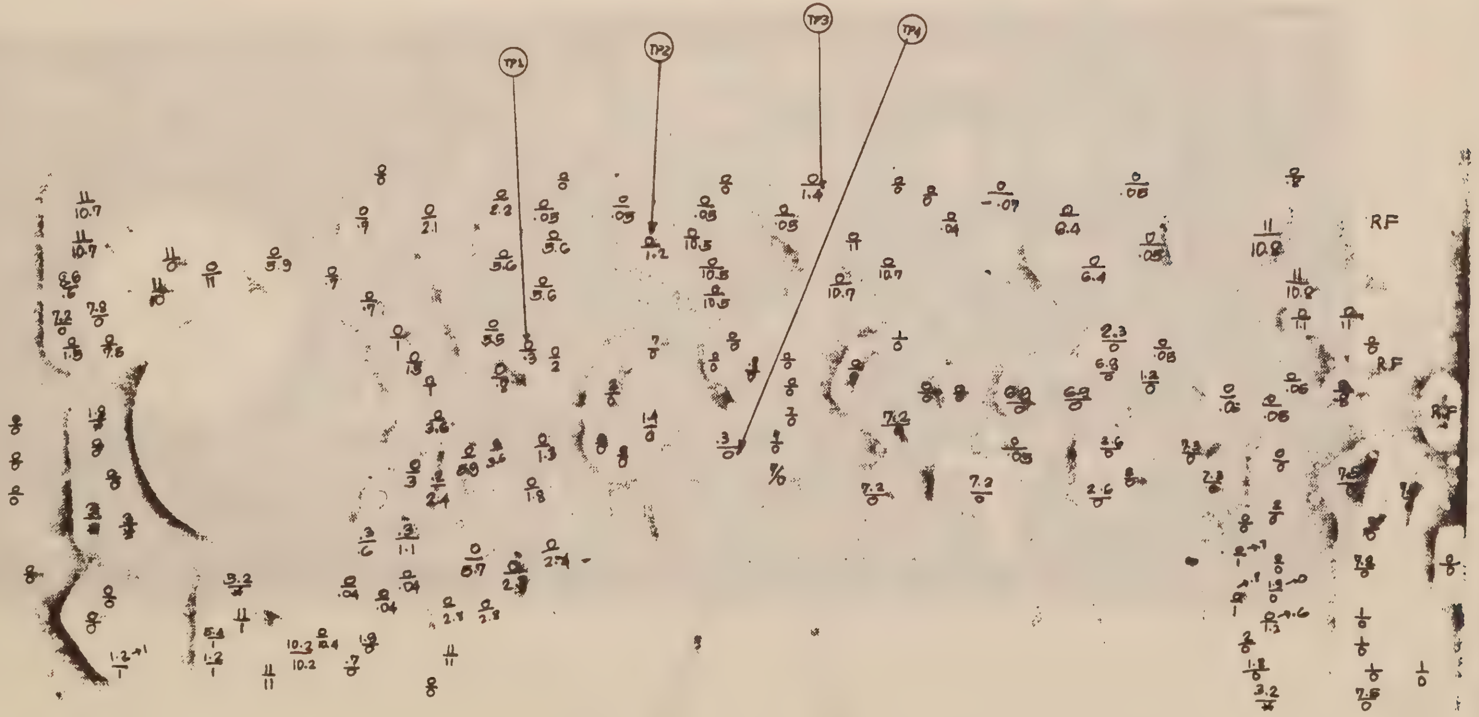
Prepared By:

Date:

Part No:

Labor Code:

Description:



* INDICATES DC VOLTAGE TENDS TO DECREASES SLOWLY TO ZERO VOLTS

→ INDICATES VOLTAGE CHANGE DURING SQUELCH.

VOLTAGES WERE OBTAINED ON 10 VHF GOOD RADIOS WITH CRYSTAL (AVE.)

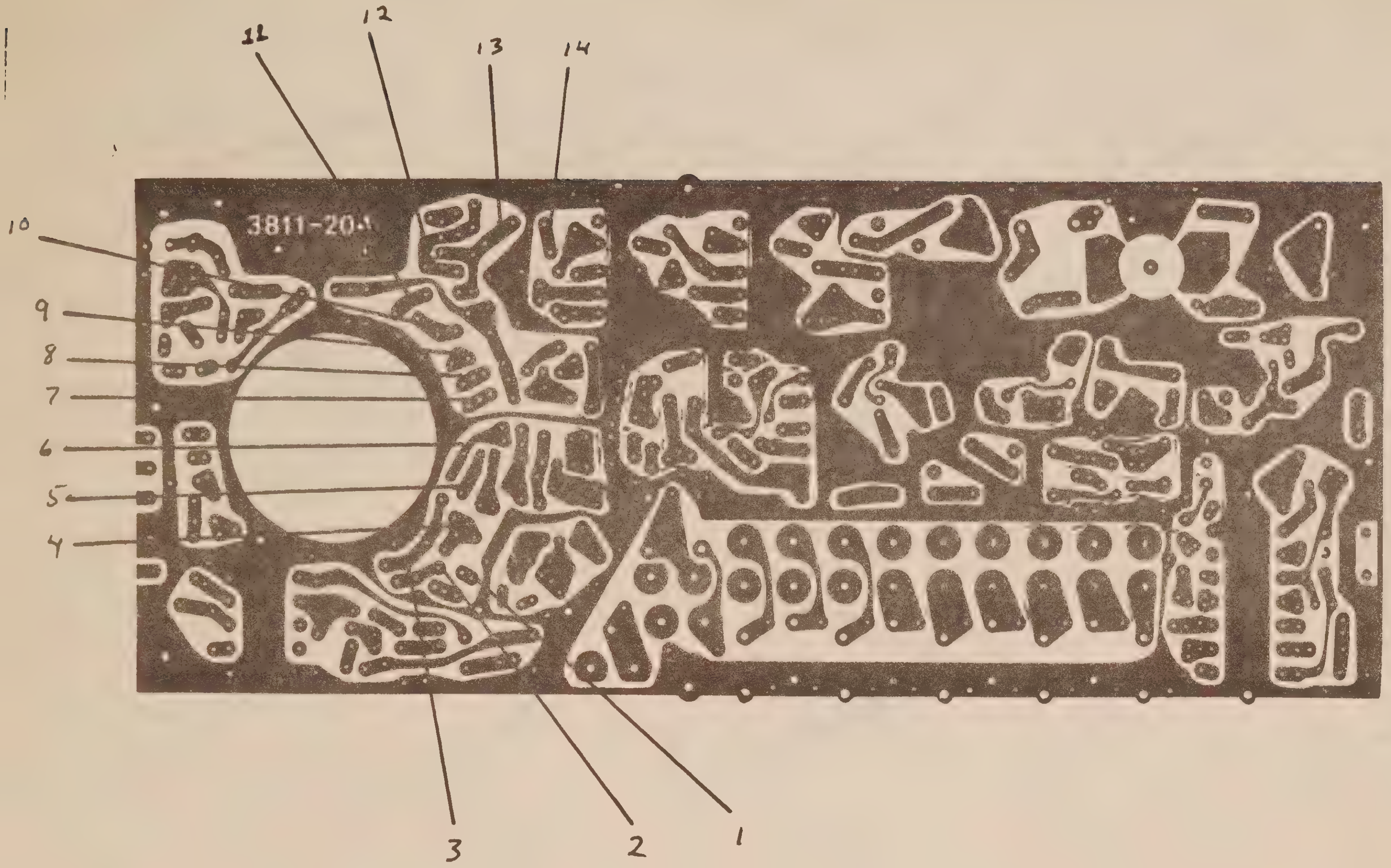
$\frac{RX}{TX}$

TEST EQUIPMENT USE:

① VTVM
HEATH SCHLUMBERGER
MODEL SM 5228

② POWER SUPPLY applying 11 volts
DC after D12

VHF MODULATION TEST POINTS


1
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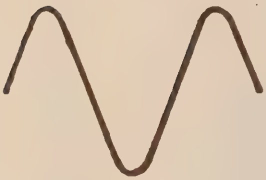
3811-20

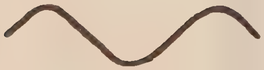
VHF MODULATOR SIGNAL WAVEFORM

① x1



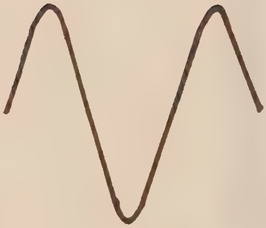
10mV

② & ③



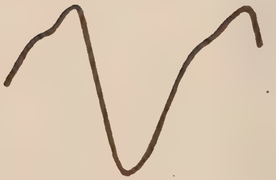
4mV

④ x10



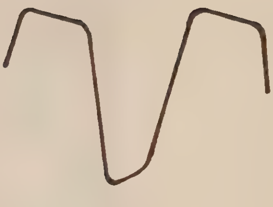
.16 volt

⑤



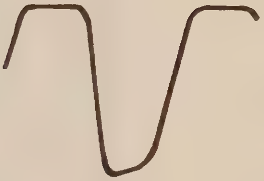
.1 volt

⑥ x1



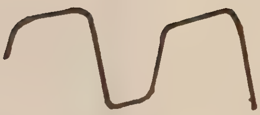
1 volt

⑦



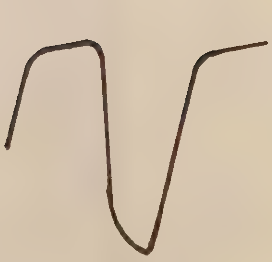
1 volt

⑧



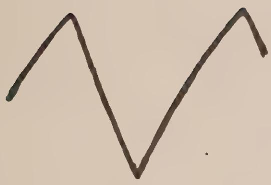
.7 volt

⑨



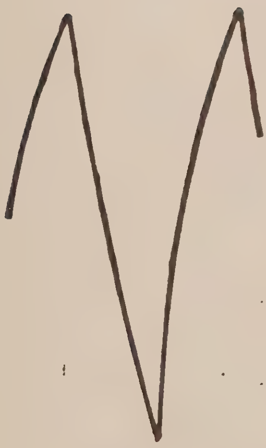
.37 volt

⑩



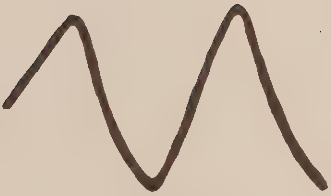
.1 VOLT

⑪ & ⑫



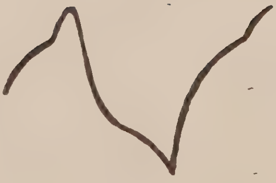
36 mVolt

⑭



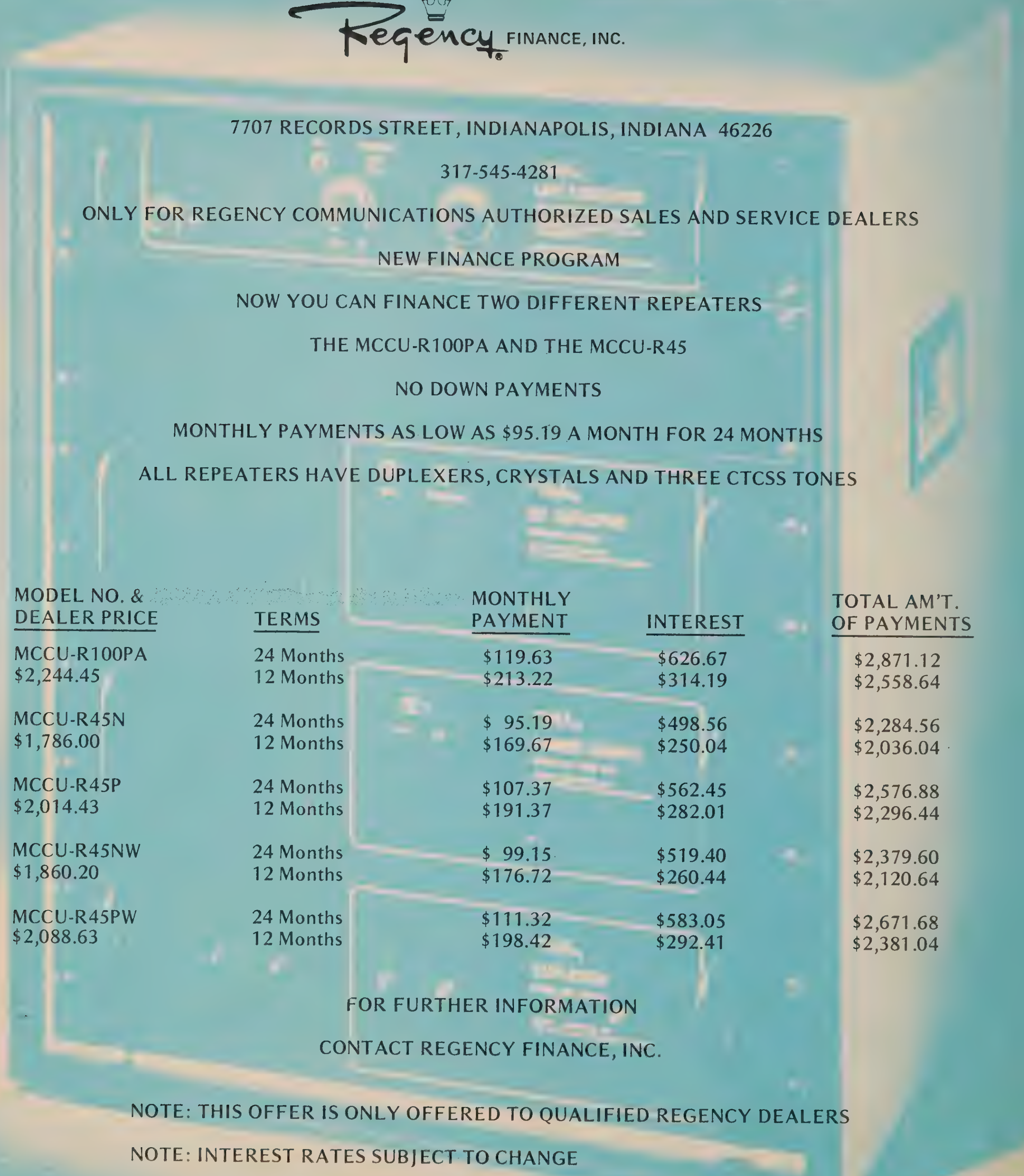
.06 VOLT

⑬



.11 volt

Regency® Communications, Inc.
1227 S. Patrick Dr., Satellite Beach, FL 32937



Regency FINANCE, INC.

7707 RECORDS STREET, INDIANAPOLIS, INDIANA 46226

317-545-4281

ONLY FOR REGENCY COMMUNICATIONS AUTHORIZED SALES AND SERVICE DEALERS

NEW FINANCE PROGRAM

NOW YOU CAN FINANCE TWO DIFFERENT REPEATERS

THE MCCU-R100PA AND THE MCCU-R45

NO DOWN PAYMENTS

MONTHLY PAYMENTS AS LOW AS $95.19 A MONTH FOR 24 MONTHS

ALL REPEATERS HAVE DUPLEXERS, CRYSTALS AND THREE CTCSS TONES

MODEL NO. & DEALER PRICE	TERMS	MONTHLY PAYMENT	INTEREST	TOTAL AM'T. OF PAYMENTS
MCCU-R100PA	24 Months	$119.63	$626.67	$2,871.12
$2,244.45	12 Months	$213.22	$314.19	$2,558.64
MCCU-R45N	24 Months	$ 95.19	$498.56	$2,284.56
$1,786.00	12 Months	$169.67	$250.04	$2,036.04
MCCU-R45P	24 Months	$107.37	$562.45	$2,576.88
$2,014.43	12 Months	$191.37	$282.01	$2,296.44
MCCU-R45NW	24 Months	$ 99.15	$519.40	$2,379.60
$1,860.20	12 Months	$176.72	$260.44	$2,120.64
MCCU-R45PW	24 Months	$111.32	$583.05	$2,671.68
$2,088.63	12 Months	$198.42	$292.41	$2,381.04

FOR FURTHER INFORMATION

CONTACT REGENCY FINANCE, INC.

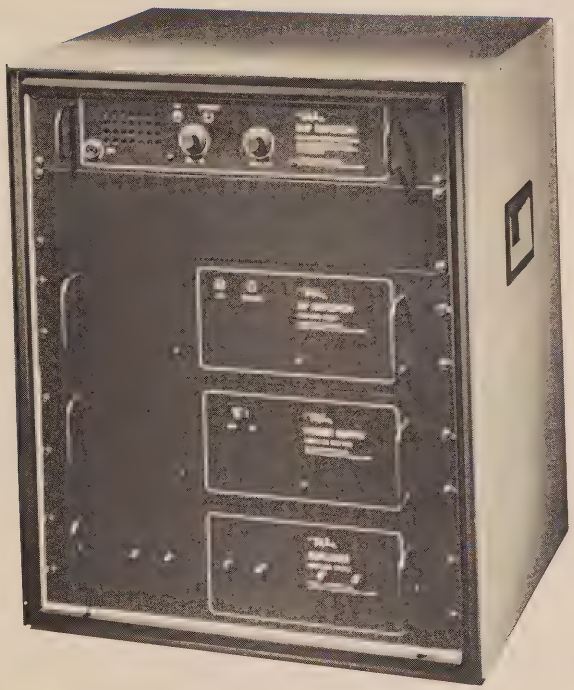
NOTE: THIS OFFER IS ONLY OFFERED TO QUALIFIED REGENCY DEALERS

NOTE: INTEREST RATES SUBJECT TO CHANGE

NOTE: ALL SHIPMENTS WILL BE FREIGHT COLLECT

Regency COMMUNICATIONS, INC.

NEW 100 WATT REPEATER. THE MCCU-R100P



The MCCU-R100P is a 450-476 MHZ continuous 100 WATT UHF Repeater equipped with: A Band Pass Duplexer, a three minute time out timer, with a warning tone, a two second drop out delay. Capability of three CTCSS Tones and with the addition of two MA-304 (optional) you can add 7 more tones for a total of 11 tones for Community Repeater use.

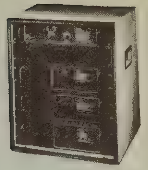
Model	Suggested Retail	Dist. Cost	Service Allowance	Sales/Service Center Cost
MCCU-RPA	3765.00	2371.95	376.50	1995.45
MCCU-RXA*	2126.00	1969.38	312.60	1656.78

Orders shipped in six to eight weeks

ORDER NOW

* Less Duplexer

Regency COMMUNICATIONS, INC.



450 - 512 MHZ
MICRO-COM REPEATER

MCCU-R100
100 WATT
UHF REPEATE

MCCU-R100	P		100 Watt UHF Repeater with Bandpass Duplexer	3765.00
	X		100 Watt UHF Repeater without duplexer	3126.00
		A	450-476 MHz	N/C
		B	470-512 MHz*	N/C
MCCU-R100				

The MCCU-R100P is a continuous 100 watt UHF Repeater, equipped with a 3 minute time out timer with warning tone, a two second drop out delay, Capability of three CTCSS tones, for (community use) a bandpass duplexer with 85db transmitter noise suppression at the receiver and 85db receive isolation at the transmit frequency. Less Crystals. Size: 21" W x 24.7" H x 17.0" D. Power Requirements: 115V 60 Hz (115 or 230 VAC 50 Hz, available through special order) Weight: 118.7 Lbs. F.C.C. data ACU 45 A or B and Micro-Com U 01R A or B

ACCESSORIES/OPTIONS

Crystals	$25.00 per pair	RX 302-539 TX 302-540
Action Call Decoder CTCSS	$80.00	MA-116
Action Call Encoder CTCSS	$50.00	MA-121
Tone Extender Panel **	$50.00	MA-306

* Not Available at this time

** MA-306 permits 4 more CTCSS tones to be added. Two MA-306's can be added to the MCCU-R100.

NOTE: ONE YEAR LIMITED WARRANTY ON PARTS AND LABOR.

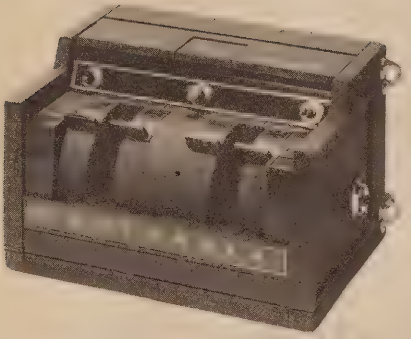
NOTE: PRICES AND PRODUCTS ARE SUBJECT TO CHANGE WITHOUT NOTICE.

MOTOROLA

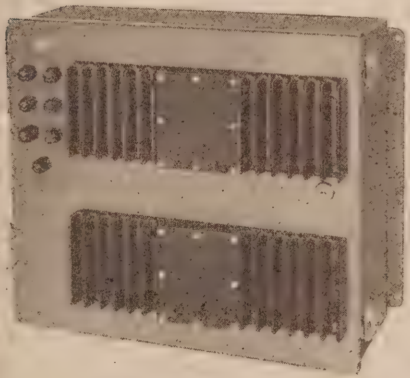
PORTABLE REMOTE CONTROLS FOR CRANES

CONSTANT CARRIER SYSTEM

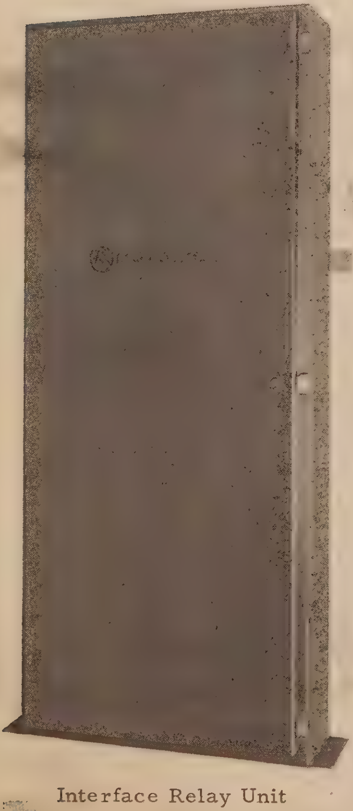
72-76 MC



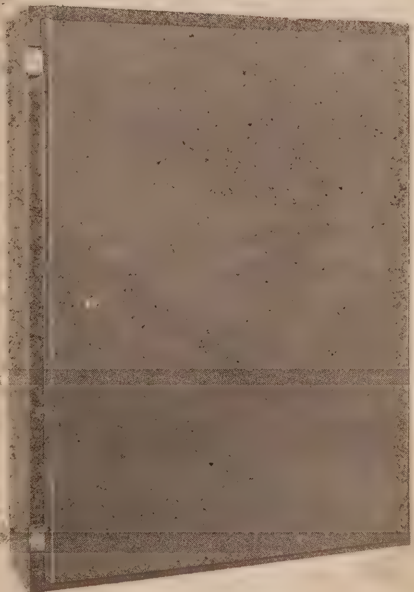
Control Transmitter Unit



DC Power Supply



Interface Relay Unit



Receiver-Decoder Unit

MOTOROLA INC. **Communications Division**

ENGINEERING PUBLICATIONS 4501 WEST AUGUSTA BOULEVARD CHICAGO, ILLINOIS 60651

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Printed in U. S. A.
1/8/70-RS

GREG BRAZIL
DELTA C+E
6613 HOLLIS
[illegible]

68P81059A05
Issue - A

DESCRIPTION

ELECTRONIC EQUIPMENT INSTALLATION & PRE-OPERATIONAL CHECKS

CONTROL TRANSMITTER UNITS

CIRCUIT BOARD REPLACEMENT

RECEIVER-DECODER UNITS

INTERFACE RELAY UNITS

POWER SUPPLIES

MAINTENANCE

SERVICE DIAGRAMS & ALIGNMENT CHARTS

GUARANTEED PERFORMANCE SPECIFICATIONS

GENERAL

FREQUENCY	72-76 mc	
SYSTEM CAPACITY	Maximum Number of Simultaneous Commands	8
	Maximum Number of Motors	5
	Maximum Number of Auxiliary Functions	5

CONTROL TRANSMITTER UNIT

MODELS	C1106B	C1108B	C1110B
MOTOR CONTROL CAPABILITY	3	4	5
POWER OUTPUT	100 mw at nominal battery voltage (13.5 v)		
FREQUENCY STABILITY	±0.0005% from -30°C to +60°C (+25°C reference)		
MODULATION	16F9: ±5 kc for 100% at 1000 cps		
CRYSTAL MULTIPLICATION	9 times		
SPURIOUS AND HARMONICS	More than 45 db below carrier		
POWER SUPPLY	On rechargeable 14.0 v nickel-cadmium battery, 8 hours continuous operation per charge at a power output of 100 mw.		
DUTY CYCLE	Continuous		
ANTENNA	Self-contained		
ENCLOSURE	Dust resistant and weatherproof		
DIMENSIONS	8-1/4" x 5-1/4" x 5-3/4"		
WEIGHT	5 lbs. 15 oz.		

RECEIVER-DECODER UNIT

MODELS	C1120B, C1124A, C1120C, C1124B*	C1121B, C1125A, C1121C, C1125B*
MOTOR CONTROL CAPABILITY	3	4 or 5
SENSITIVITY	Less than 0.4 microvolt for 20 db quieting	
SELECTIVITY	-100 db at ±15 kc; 20 db quieting: -80 db at ±30 kc; EIA SINAD	
MODULATION ACCEPTANCE	±7 kc minimum	
FREQUENCY STABILITY	±0.0005% from -30°C to +75°C (+25°C reference)	
SPURIOUS AND IMAGE REJECTION	More than 100 db	
OPERATING TEMPERATURE RANGE	-30°C to +75°C	
ENCLOSURE	NEMA 12	
DIMENSIONS	34" x 26" x 9"	
WEIGHT	150 lbs.	

* 2-Frequency Model

INTERFACE RELAY UNIT

DC MODELS	C1146A	C1147A	C1148A	C1149A	C1180A
AC MODELS	C1156A	C1157A	C1158A	C1159A	C1185A
MOTOR CONTROL CAPABILITY	3		4th	4th and 5th	
SPEEDS PER MOTOR	3	5	3	3	5
INPUT POWER	250 v dc (dc models); 120 volts 60 cycles (ac models)				
OUTPUT RELAY RATING	Contacts capable of driving NEMA size 6 contactors (NEMA size 8 contactors are optional)				
OPERATING TEMPERATURE RANGE	-30°C to +75°C				
ENCLOSURE	NEMA 12; 3 motor systems require one enclosure; 4 and 5 motor systems require 2 enclosures.				
DIMENSIONS	63" x 26" x 9"				
WEIGHT	225 lbs.				

POWER SUPPLY UNIT

MODELS	C1160B	C1161A	C1162A
INPUT REQUIRED	250 v dc	120 volts, 50-60 cps single phase	240/440 volts, 50-60 cps, single phase
OUTPUT VOLTAGES	18, 14 and 3.9 v dc		
OPERATING TEMPERATURE RANGE	-30°C to +75°C		
ENCLOSURE	NEMA 12		
DIMENSIONS	14" x 17-1/2" x 7"		
WEIGHT	47 lbs	34 lbs.	59 lbs.

C1163A Filter has dimensions of 16" x 17-1/2" x 7" and weight of 33 lbs.

SPECIFICATIONS SUBJECT TO CHANGE WITHOUT NOTICE
FCC LICENSE DESIGNATION: CC2004A

FOREWORD

NOMENCLATURE

Motorola radio equipment is specifically identified by the model number on the nameplate.

NOTE

Be sure to use the enitre model number when making inquiries about your equipment.

Identifiers have been assigned to chassis and kits. Use these identifiers when requesting information or ordering replacements.

PRODUCTION CHANGES

When production and engineering changes are incorporated into the equipment, a revision numeral is assigned to the chassis or kit affected.

Typical Example:
The Model NTD6041AA becomes NTD6041AA-1 with the first revision.

This chassis number complete with revision numeral, if any, is stamped on the chassis at the time of production. The revision numeral becomes an integral part of the chassis identifier.

A schematic diagram number complete with its issue letter is also stamped on each chassis. This establishes direct correlation between the chassis and its schematic. The schematic issue is advanced each time a change occurs in the chassis.

INSTRUCTION MANUAL REVISIONS

Changes which occur after an instruction manual is printed are described in the Instruction Manual Revision. These bulletins give the reader complete information on the change including pertinent parts listing data.

NATIONAL SERVICE ORGANIZATION

Motorola provides a nation-wide service organization. Through its maintenance and installation program Motorola makes available the finest service to those desiring reliable continuous communications on a contract basis.

NATIONAL
MOTOROLA
COMMUNICATIONS
SERVICE

The largest service organization specializing in mobile communications is Motorola's National Service Organization. Over 800 strategically located, adequately staffed and trained, independently owned and operated stations, manned with several thousand FCC licensed personnel constitute the sub-contracting force.

The administrative forces of area and district service managers and district service representatives are in the direct employ of Motorola.

For your contract service requirements please contact your local Motorola representative or write to:

National Service Manager
Motorola Communications Division
4501 W. Augusta Blvd., Chicago, Illinois 60651

REPLACEMENT PARTS ORDERING

Motorola maintains parts and service depots and authorized service stations strategically located throughout the country. These facilities are fully equipped to give the finest service.

When ordering replacement parts, the complete number identification of the item must be used whether it be a component, kit or complete chassis. This will fix proper identification and insure receipt of the desired item. Complete number identification should also be used when requesting equipment information.

Crystal orders should specify crystal type number, crystal frequency, carrier frequency and the chassis model number in which the crystal is to be used.

Orders for "Vibrasender", "Vibrasponder" and "Vibrasender-sponder" units should specify the type number and frequency and should identify the owner and operator of the communications system in which these items are to be used.

CAREFUL USE OF THE INSTRUCTION MANUAL AND THE MANY SUGGESTIONS CONTAINED IN IT WILL FURTHER INSURE PROPERLY INSTALLED AND MAINTAINED RADIO EQUIPMENT.

THE EQUIPMENT DESCRIBED IN THIS MANUAL IS MANUFACTURED UNDER ONE OR MORE OF THE FOLLOWING MOTOROLA U.S. PATENTS:

RE-24,110
RE-24,815
RE-26,079
RE-26,361
2,583,032
2,608,648
2,608,649
2,626,384
2,637,782
2,650,333
2,688,059
2,691,094
2,691,560
2,699,425
2,705,281
2,731,555
2,738,466
2,740,891
2,743,361
2,759,052
2,759,103
2,777,950
2,799,010
2,808,507
2,809,236
2,830,200
2,833,994
2,834,879
2,883,521
2,888,652
2,899,547
2,901,601
2,912,573
2,918,571
2,924,705
2,925,562
2,938,082
2,963,577
2,966,585
2,974,221
2,984,740
2,994,844
3,009,115
3,014,127
3,027,454
3,027,455
3,039,081
3,041,550
3,048,659
3,048,747
3,059,184
3,061,785
3,070,737
3,070,748
3,083,332
3,087,117
3,087,998
3,087,999
3,091,736
3,094,293
3,101,441
3,119,093
3,126,514
3,128,431
3,129,396
3,131,354
3,149,317
3,175,183
3,175,187
3,175,193
3,183,382
3,191,123
3,204,202
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3,233,243
3,234,469
3,247,475
3,250,997
3,250,999
3,256,497
3,263,172
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3,281,697
3,284,714
3,289,098
3,292,085
3,293,644
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3,304,503
3,305,779
3,306,990
3,307,051
3,307,121
3,323,065
3,324,408
3,327,215
3,328,695
3,328,727
3,333,151
3,333,911
3,334,293
3,335,405
3,336,533
3,341,777
3,345,568
3,345,569
3,345,573
3,348,148
3,355,533
3,355,709
3,369,597
3,370,236
3,373,379

Other U.S. Patents Pending

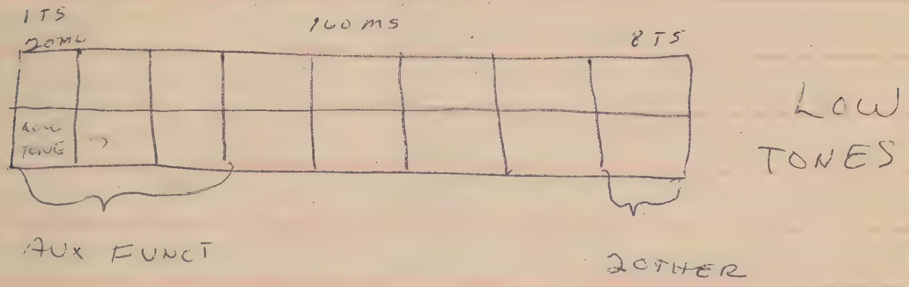
BATTERY WARRENTY 1 YEAR

Good for ABOUT 400 hrs.

use 8 hrs charge 16 hrs.

Address PLUG IN BATTERY COMP.

MOST PRC's 72mc


1 TS
20ms
100 ms
8 TS
AUX TONE
LOW
TONES
AUX FUNCT
2 OTHER

ONE G - off FUNCTION

ONE F - ON ''

AUX FUNCTIONS MUST BE IN TS 1, 2, 3 OR 8

TS 4 BRIDGE CONTROL TONE "E"

TS 5 TROLLEY '' TONE "D"

S6 HOIST '' "CB"

S 7 AUX HOIST '' TONE "B"

S 8 MAG ON-OFF'' TONE "A"

SECURITY TONES

OLE TONE ON TS 4-8 inc-

Hi TONES

IDGE TONE ON Hi IS "U" 2830 N

RST 3 Hi TONES ARE ADDRESS FOR CRANE

NES. ARE : T, S, R, P, N, M 120 POSSIBLE ADDRESSES

ddress TONES HAVE TO HAVE A FOR G FOR COMPLETE ADP

Hi TONE J is off } TIME SLOT 8

AUX FUNCTIONS IN TS 8
ONE L AND K

Hi TONE L WITH F/6 ONE AUX FUNCT
TONE K WITH F/6 2 AUX FUNCT.

LOW TONE

ONE G	1270	ADD - AUX FUN
F	1140	ADD - AUX FUN
E	1010	MOTOR 1
D	880	MOTOR 2
C	750	MOTOR 3
B	620	MOTOR 4
A	490	AUX

Hi TONE

2830	STOP	
2700	R5	- ADD
2570	F5	ADD
2440	R4	- ADD
2310	F4	- ADD
2180	R3	- ADD
2050	F3	ADD

L	1920	AUX	R2
K	1790	AUX	F2
J	1660	AUX	R1
H	1530	AUX	F1

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IMPORTANT

This instruction manual covers all Motorola constant carrier crane control equipment, including auxiliary function kits and accessories (except receiving antenna). In cases where more than one crane control system is provided, it is advisable to mark the crane number on the related instruction manual cover to avoid confusion. Systems installation information is supplied separately.

1. GENERAL

The Motorola portable remote control (PRC) for cranes provides constant carrier control of overhead bridge cranes from a control transmitter unit which is worn by the operator. The control transmitter duplicates the controls normally found in the cab or on the pendant of a crane. Thus, crane control is placed on the floor which allows the operator to choose the most advantageous location for each operation.

The system operates in the 72-76 mc band and consists of a control transmitter, receiver-decoder, antenna, interface relay unit and power supply. A highly secure coding scheme is used to convey commands from the control transmitter to the crane. This eliminates the possibility of falsing which could result in dangerous crane operation.

When the control transmitter key switch is turned ON and the PULL ON-PUSH OFF switch is pulled, a unique sequence of tone- and time-coded radio signals are sent to the receiver-decoder on the crane. The constant-carrier safety feature of the control transmitter provides continuous transmission of radio signals so that the crane becomes inoperative when the transmitter signal is turned off. The PUSH-TO-OPERATE bar must be pressed to control the crane motors. The decoded signals at the receiver-decoder activate control relays which, in turn, operate crane controllers. This causes the brake to release and the appropriate motor to start movement of the bridge, trolley, or hoist, or all simultaneously if commanded.

The system has a capacity which allows the operator to control a maximum of five motors with up to five speeds in each direction. A number of auxiliary functions such as rotating a hook, opening and closing a grapple, turning lights on and off, etc., may also be commanded from the control transmitter.

Completely solid-state circuitry is used throughout, insuring maximum reliability and minimum equipment down time. The control transmitter is enclosed in a dust-resistant and weatherproof housing made of high impact plastic capable of resisting the rugged use encountered in crane operation. The transmitter operates from a self-contained rechargeable nickel-cadmium battery which will provide eight hours of continuous operation. The bridge-mounted receiver-decoder, interface relay unit and power supply are housed in dust-resistant, weather-proof aluminum cabinets. The receiver-decoder uses plug-in circuit boards to facilitate servicing.

2. CODING SCHEME

The unique coding scheme employed in this system provides protection against falsing by interfering signals and it has the ability to simultaneously perform a number of control functions. Specifically, a unique sequence of tones called a command frame is used to convey the transmitter unit command instructions. This command frame is continuously transmitted at a rate of 6 frames per second. A typical command frame is shown on page 1-2.

Note that the command frame is subdivided into 8 time intervals denoted as time slots. A unique two-tone pair appears within each time slot, one tone of a specific low audio frequency group and one tone of a high frequency group. The low frequency tone may be one of seven

MOTOROLA INC. Communications Division
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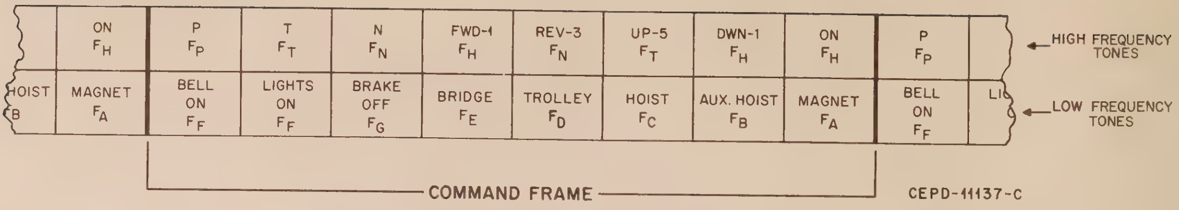

ON F_H
P F_P
T F_T
N F_N
FWD-1 F_H
REV-3 F_N
UP-5 F_T
DWN-1 F_H
ON F_H
P F_P
HIGH FREQUENCY TONES
HOIST B
MAGNET F_A
BELL ON F_F
LIGHTS ON F_F
BRAKE OFF F_G
BRIDGE F_E
TROLLEY F_D
HOIST F_C
AUX. HOIST F_B
MAGNET F_A
BELL ON F_F
LI
LOW FREQUENCY TONES
COMMAND FRAME
CEPD-11137-C

Typical Command Frame

available tones and the high frequency tone may be one of eleven available tones. The first three time slots are allocated to the crane address and three auxiliary functions. In the typical command frame depicted above the sequence of three high frequency tones in the first three time slots represents the address of the crane unit being operated. Since three of a possible six high frequency tones are used for the address scheme, a capability of 120 (6 x 5 x 4) distinct addresses per radio channel are available. One of two low frequency tones will accompany the three high frequency tones in the first three time slots allocated to the address. These low frequency tones form a necessary part of the address code; however, either of the two tones will satisfy the address requirements in these three time slots. The ON or OFF state of specific auxiliary functions is determined by which of the two tones is present in a time slot. In this case, tone F_F is used as an ON command and tone F_G as an OFF command.

The remaining five time slots are allocated to the motor control functions and other critical auxiliary functions. Each motor control time slot is identified by the presence of a unique low frequency tone in addition to its position in the command frame relative to the address. For example, low frequency tone F_E will appear only in the 4th time slot and in no other. One of the eleven distinct high frequencies available will accompany each low frequency in its associated time slot to command one of eleven different states. For example, the fourth time slot may be allocated to the bridge motor. The eleven states commanded would be five speeds forward, five speeds reverse and a neutral or rest condition. This unique coding scheme prevents impulse and ignition noises normally found in industrial areas from generating false commands.

INSTALLATION & PRE-OPERATIONAL CHECKS

1. UNPACKING

Inspect the equipment thoroughly as soon as possible after delivery. If any part of the equipment has been damaged in transit, report the damage to the transportation company immediately.

2. PANEL INSTALLATION

All cabinets, conduits, intercabinet wiring, and the antenna should have been previously installed. The instructions for installing these units are supplied with that equipment. The information contained in these instructions should be thoroughly double-checked at this time. Needless troubleshooting can be eliminated by making sure that the installation instructions have been followed carefully.

When more than one crane is being equipped with radio control, make sure that the proper receiver-decoder unit and interface relay panels are installed in each. These units, and/or the packing cartons they are shipped in, have a serial number stamped on them for identification. The hoist matrix and relay chart located in the installation instructions cross references the serial numbers to a particular crane.

To simplify installation, the doors may be removed from the receiver-decoder and interface relay cabinets. This may be done easily by lifting them off their hinge pins. The doors can be replaced when the installation is finished.

a. Step 1

If the front door of the power supply (mounting the electronic components) has been removed, it should be replaced at this time. The cable connecting the front door to the terminal boards on the cabinet back should also be reconnected. Refer to the appropriate Power Supply Schematic Diagram for exact connection details.

When an external switch is used to remove power from the relay power circuits, the RED-WHT jumper between TB301-1 & -2 and the BRN-BLU jumper between TB301-2 & -4 must be removed.

On dc controlled cranes, the door of the RC Filter should be replaced if it was removed during installation.

b. Step 2

Apply power to the system. Check the terminals on the equipment cabinets for proper voltages as shown on the following table.

LOCATION	TERMINAL BOARD	VOLTAGE (DC)
Receiver-Decoder Cabinet	TB105-1 TB104-4 TB105-14	3.9 ±0.5 14 ±1 18.5 ±1
Interface Relay Cabinet	TB201-5 TB201-4 TB201-2 *TB201-1 & TB202-1	3.9 ±0.5 14 ±1 18.5 ±1 250 v dc or 120 v ac

*Voltage referenced to TB104-5 (circuitry ground)

WARNING

ALL VOLTAGES MUST BE AS NOTED IN THE PRECEDING TABLE TO PREVENT DAMAGE TO THE UNIT.

After checking these voltages, remove power from the unit and proceed with step 3.

c. Step 3

Remove the receiver-decoder unit from the wooden shipping rack. The four shipping bolts, nuts and lockwashers may be discarded. A hardboard panel is mounted on the front of the unit to protect the electronic components from accidental jarring and damage. This hardboard panel should be left in place while the equipment is being transported from the floor to the crane bridge. The panel, its six standoffs and wingnuts, can then be removed and discarded.

The receiver-decoder panel is fastened to the cabinet by seven bolts, (5/16-3/4), washers and lockwashers which were shipped with the cabinet. Remove these bolts from the cabinet. Position the receiver-decoder panel in the cabinet and fasten it in place using the seven bolts, lockwashers and flat washers.

d. Step 4

After the receiver-decoder unit has been mounted, connect the fanning strips coming from the printed circuit boards to their respective terminal boards as shown in Figure 1. One fanning strip at the upper right hand portion of the unit must be connected to terminal board TB104.

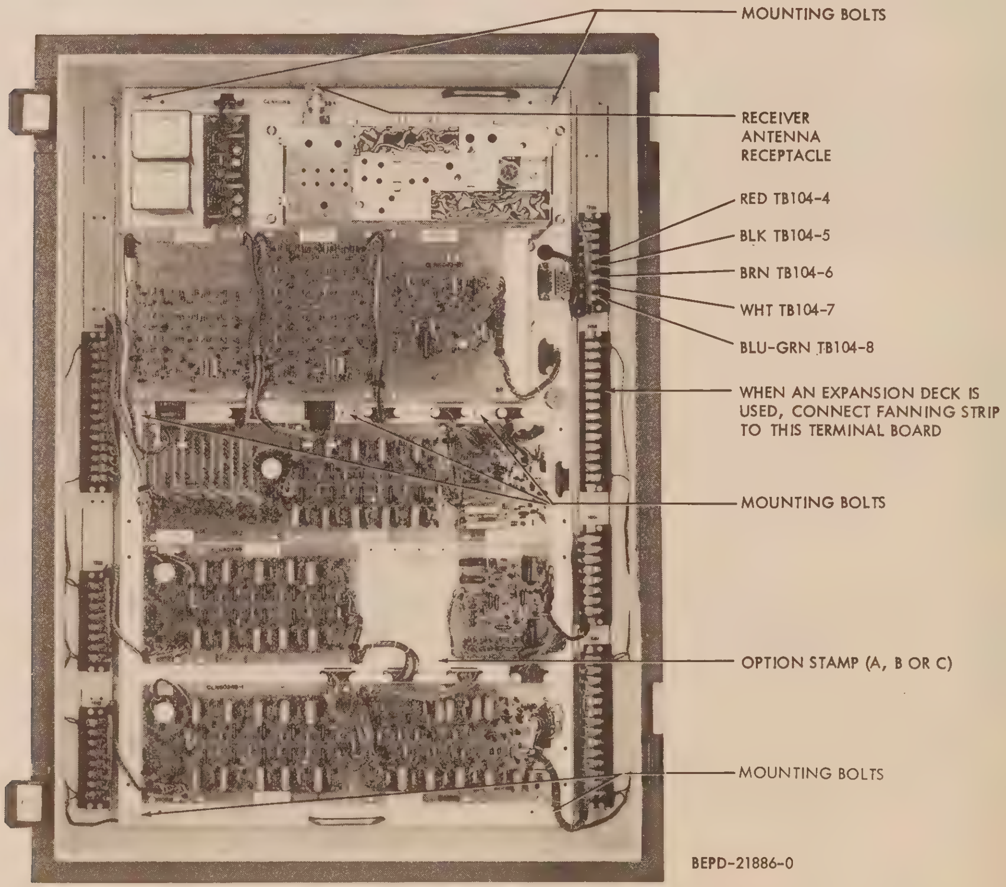
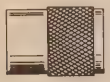

MOUNTING BOLTS
RECEIVER ANTENNA RECEPTACLE
RED TB104-4
BLK TB104-5
BRN TB104-6
WHT TB104-7
BLU-GRN TB104-8
WHEN AN EXPANSION DECK IS USED, CONNECT FANNING STRIP TO THIS TERMINAL BOARD
MOUNTING BOLTS
OPTION STAMP (A, B OR C)
MOUNTING BOLTS
BEPD-21886-0

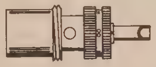
Figure 1.
Receiver-Decoder Unit Mounting

A UHF connector to terminate this cable was supplied with the original shipment. It should be connected to the antenna cable in the following manner:

(1) Disassemble the connector.

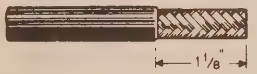


COUPLING RING

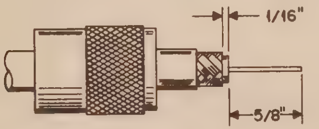


PLUG SUB–ASSEMBLY

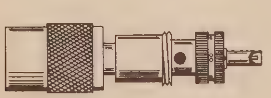
(2) Cut off one end of the cable squarely and remove 1-1/8" of the vinyl jacket.



(3) Trim end of cable so that 5/8" of the center conductor is bare and 1/16" of dielectric remains. Tin the exposed conductor and braid. Slide the back shell and coupling ring onto the cable.



(4) Screw the plug sub-assembly onto the cable. Solder the plug sub-assembly to the braid through the solder holes. Solder the center conductor to the contact.



CAUTION

Use a very hot iron, solder quickly and chill immediately with a wet cloth. Do not use excessive heat or solder.

sub-assembly. Position the back shell so that sufficient clearance remains to premit rotation of the coupling nut. Tighten the set screw.

(6) Connect the cable to the receiver antenna receptacle. Tighten the coupling ring.

e. Step 5

A typical portable remote control system may be composed of one or two interface relay cabinets. The individual relay panels which must be mounted in each cabinet are boxed separately and packed in a shipping carton. There is one shipping carton for each interface relay cabinet. When the relay panels are unpacked it will be noted that a number showing its cabinet and location in that cabinet is stamped on the front of each panel. For example, the first panel in the first cabinet will be stamped PANEL 1-1 (in systems equipped with magnet or grapple control, the first panel is stamped PANEL 1-0). These panels must be mounted in their respective cabinets using the tapping screws, (#14-14) and speed nuts supplied with the cabinet as part of the CLN6120A Cabinet Accessory Kit. The top screws of PANEL 1-0 in the first interface cabinet should be installed in the 4th hole from the top of the cabinet. For mounting PANEL 1-1, the top screws should be installed in the 13th hole from the top of the cabinet. Refer to Figure 2. After the panel is mounted, connect the two fanning strips on each side of the panel to terminal boards located on the left and right sides of the cabinet and tighten all screws securely. The remaining panels should be mounted in a similar manner leaving no space between panels unless a panel is not included in a particular model. If a panel is omitted from a model, 24 holes should be skipped from the top mounting hole of one panel to the top mounting hole of the next panel.

Depending on crane requirements, this equipment is or must be wired for one of three options, A, B or C. The option required by the customer is determined at the factory and is stamped near J14 in the receiver-decoder cabinet (refer to Figure 1.) Follow the installation instructions provided with the equipment.

NOTE

Refer to the separately supplied inter-cabinet connection and installation instructions for wiring information.

The relay panels are mounted in the auxiliary interface cabinet in a similar manner with the exception that no more than five panels will be used in

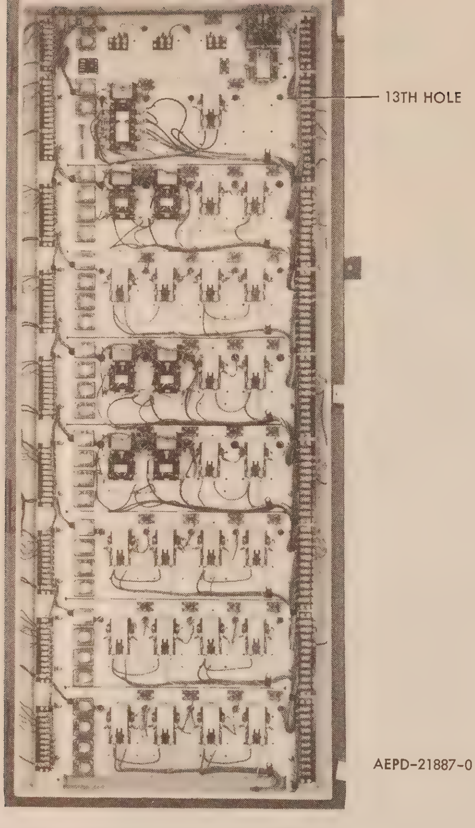


Figure 2.
Interface Relay Unit Mounting

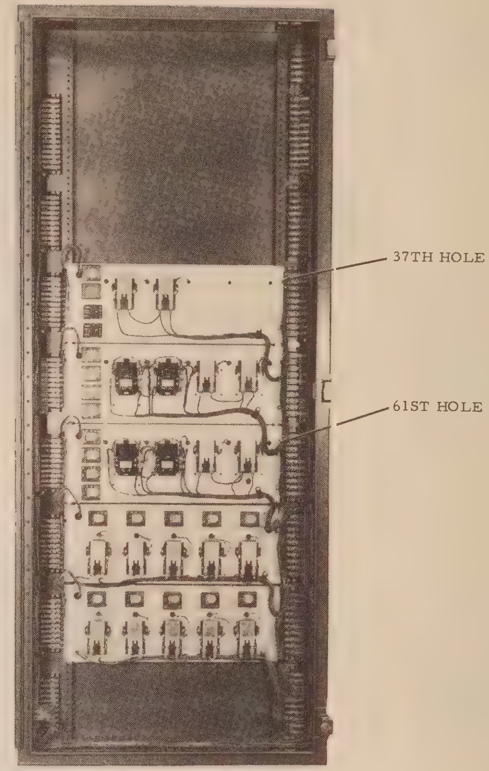


Figure 3.
Auxiliary Interface Relay Unit Mounting

any particular system. The top hole of the first panel in the auxiliary interface cabinet should be mounted in the 37th hole from the top for five-motor systems or the 61st hole for four-motor systems. Refer to Figure 3.

3. PRE-OPERATIONAL CHECKS

a. Purpose

The purpose of the pre-operational checks is to make sure the equipment is working properly before it is used to control the crane. Essentially, the checks consist of actuating the various controls on the control transmitter and checking to see that the proper intermediate power relays in the interface relay group and their associated motor control contactors are operating.

b. Preliminary Set-Up

(1) Step 1

Remove power from the various crane motors. This can usually be done by opening the motor controller power switches at the controller panel of each motor.

(2) Step 2

Apply power to the crane and the remote radio control equipment.

(3) Step 3

Place a fresh battery in the control transmitter and turn the key switch on.

(4) Step 4

Net the receiver-decoder unit to the control transmitter; refer to step 5 of Receiver Alignment Procedure for details.

c. Checkout Procedure

Refer to the intercabling and equipment location diagram for the interface relay unit and the separately supplied intercabinet connection and installation instructions. All intermediate power relays, with the exception of those that control motor direction, are connected in parallel with corresponding contactors of the crane motor

BRIDGE	FORWARD	SPEED 4	1-2-BF	1-2-B2	1-2-B3	1-3-B4	(NOTE 2)
BRIDGE	FORWARD	SPEED 5	1-2-BF	1-2-B2	1-2-B3	1-3-B4	1-3-B5
BRIDGE	REVERSE	SPEED 1	1-2-BR				
BRIDGE	REVERSE	SPEED 2	1-2-BR	1-2-B2			
BRIDGE	REVERSE	SPEED 3	1-2-BR	1-2-B2	1-2-B3		
BRIDGE	REVERSE	SPEED 4	1-2-BR	1-2-B2	1-2-B3	1-3-B4	
BRIDGE	REVERSE	SPEED 5	1-2-BR	1-2-B2	1-2-B3	1-3-B4	1-3-B5
TROLLEY	FORWARD	SPEED 1	1-4-TF				
TROLLEY	FORWARD	SPEED 2	1-4-TF	1-4-T2			
TROLLEY	FORWARD	SPEED 3	1-4-TF	1-4-T2	1-4-T3		
TROLLEY	FORWARD	SPEED 4	1-4-TF	1-4-T2	1-4-T3	1-3-T4	
TROLLEY	FORWARD	SPEED 5	1-4-TF	1-4-T2	1-4-T3	1-3-T4	1-3-T5
TROLLEY	REVERSE	SPEED 1	1-4-TR				
TROLLEY	REVERSE	SPEED 2	1-4-TR	1-4-T2			
TROLLEY	REVERSE	SPEED 3	1-4-TR	1-4-T2	1-4-T3		
TROLLEY	REVERSE	SPEED 4	1-4-TR	1-4-T2	1-4-T3	1-3-T4	
TROLLEY	REVERSE	SPEED 5	1-4-TR	1-4-T2	1-4-T3	1-3-T4	1-3-T5
HOIST	DOWN	ALL SPEEDS	1-5-HB	(NOTE 6)			
HOIST	UP	ALL SPEEDS	1-5-HA	(NOTE 6)			
AUXILIARY TROLLEY	FORWARD	SPEED 1	2-4-TF				
AUXILIARY TROLLEY	FORWARD	SPEED 2	2-4-TF	2-4-T2			
AUXILIARY TROLLEY	FORWARD	SPEED 3	2-4-TF	2-4-T2	2-4-T3		
AUXILIARY TROLLEY	FORWARD	SPEED 4	2-4-TF	2-4-T2	2-4-T3	2-3-T4	
AUXILIARY TROLLEY	FORWARD	SPEED 5	2-4-TF	2-4-T2	2-4-T3	2-3-T4	2-3-T5
AUXILIARY TROLLEY	REVERSE	SPEED 1	2-4-TR				
AUXILIARY TROLLEY	REVERSE	SPEED 2	2-4-TR	2-4-T2			
AUXILIARY TROLLEY	REVERSE	SPEED 3	2-4-TR	2-4-T2	2-4-T3		
AUXILIARY TROLLEY	REVERSE	SPEED 4	2-4-TR	2-4-T2	2-4-T3	2-3-T4	
AUXILIARY TROLLEY	REVERSE	SPEED 5	2-4-TR	2-4-T2	2-4-T3	2-3-T4	2-3-T5
AUXILIARY HOIST	DOWN	ALL SPEEDS	2-5-HB	(NOTE 6)			
AUXILIARY HOIST	UP	ALL SPEEDS	2-5-HA	(NOTE 6)			
ALARM			1-7-6 (ALARM) or 1-8-1 (NOTE 4)				
AUXILIARY FUNCTION C			1-8-1 or 1-7-6 and 1-7-9 (NOTE 4)				
AUXILIARY FUNCTION B (1270 cps, OFF)			1-8-2	(NOTE 3)			
AUXILIARY FUNCTION B (1140 cps, ON)			1-8-3	(NOTE 3)			
AUXILIARY FUNCTION A (OFF)			1-8-4	(NOTE 3)			
AUXILIARY FUNCTION A (ON)			1-8-5	(NOTE 3)			
MAGNET ON			1-0-7	(MAGNET LATCHED)			
MAGNET OFF			1-0-7	(MAGNET UNLATCHED			
AUXILIARY FUNCTION BL			1-8-2				
AUXILIARY FUNCTION BR			1-8-3				
GRAPPLE ON			1-0-7	(GRAPPLE CLOSE)			
GRAPPLE OFF			1-0-8	(GRAPPEL OPEN)			

NOTES:

1. Nomenclature corresponds to relay designations on the intercabling and equipment location diagram for the Interface Relay Unit. For example, relay 1-2-BF is the bridge forward speed 1 relay in the first cabinet on the second panel.
2. In 3 speed systems, relays 4 and 5 are not present. Forward and reverse relays 2 and 3 operate when speeds 3, 4 and 5 are commanded.
3. Systems equipped with an OPERATOR RELEASE have two relays for this function.
4. Systems equipped with an OPERATOR RELEASE in Auxiliary Function position C have Alarm in 1-8-1.
5. Functions A, B, BL, BR and C refer to the switch positions on the Auxiliary Function Switch Kits location and wiring detail for the Control Transmitter.
6. The relays used for each speed cannot be designated in this table due to the unique requirements of the many hoist controller circuits. The UP and DOWN relays are standard for all hoists.

direction controller relays, in addition to operating individual direction contactors, also operate the main motor contactors and have contacts wired in series with the undervoltage relays.

WARNING

> High voltage is present in the interface relay cabinet and motor controller panels. Use extreme care when working in this cabinet.

(1) Step 1

Turn the control transmitter key switch to ON and pull the PULL ON-PUSH OFF switch. The operate relay located on the left side of panel 1-1 will pull up. Next check the individual control functions in accordance with the preceding table, remembering that the PUSH-TO-OPERATE bar must be pressed to command any motor function.

(2) Step 2

Refer to the auxiliary and main hoist matrix and relay chart(s) which also accompanies this manual. This chart has 10-columns--5 each for the up and down speeds of the hoist. Along the left side of the chart are a number of letters: A, B, J, etc. These letters correspond to relays in the hoist section of the interface relay group. This chart shows which relays operate when various speeds and directions are commanded. For example, each "X" in the U1 column corresponds to a relay which operates when both the hoist and auxiliary hoist up-speed-one function is commanded.

(3) Step 3

When one crane is to be operated from two control transmitters, a function known as OPERATOR RELEASE is employed. It is used to prevent unexpected and potentially dangerous operation of the crane by two operators at the same time. Initially, the crane control is in a first-come, first-served condition. When one of the operators takes command of the crane, the other operator is locked out. The second operator remains locked out until an auxiliary function (OPERATOR RELEASE) is actuated or, after the first operator has ceased transmission, a timer's preset time limitation is exceeded. If control of the crane is relinquished by either of these methods, it is again placed on a first-come, first-served basis. If the crane control system is to be used with two control transmitters, check both transmitters to see that they operate as described.

(4) Step 4

Manually lift the operate relay. The activity relay on the power relay panel (1-1) which is normally closed should drop out. Now relay should remain de-energized and, no motor or auxiliary relays should operate, until the main power relay is released and the activity relay has again energized.

(5) Step 5

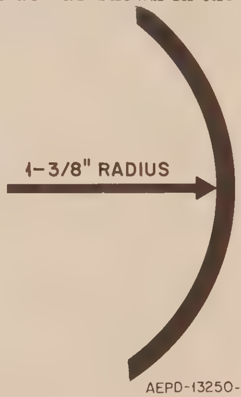
Return the motor controller power switches to their ON position. The checkout procedure is completed and the crane is ready for operation.

(6) Step 6

While controlling a crane function, walk to the extreme point from which the crane will be controlled. Control of the crane should be maintained at all times.

(7) Step 7

The control transmitter is shipped from the factory without motor direction labels. Self adhesive labels are provided in a kit (Model CLN6115A) which is packed with the control transmitter. This is done so that the actual direction, NORTH, SOUTH, EAST, WEST, FWD or REV that the bridge or trolley will travel, can be placed on the unit. Before affixing the labels to the housing, form them to the contour of the mounting surface as shown in the following detail.



AEPD-13250-0

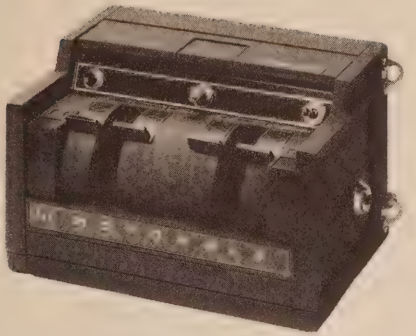
Figure 4.
Label Fastening

This radius is slightly smaller than that of the mounting surface to insure proper adhesion. After making sure the housing is clean, remove the paper backing from the label and press it firmly onto the mounting surface.

NOTE

> To obtain stronger adhesion, make the mounting surface coarse. Clean surface and apply a two-part epoxy evenly over the surface.

CONTROL TRANSMITTER UNITS



MODEL TABLE

MODEL	DESCRIPTION
C1106B	Three-Motor
C1108B	Four-Motor
C1110B	Five-Motor

1. GENERAL DESCRIPTION

This control transmitter unit allows an operator to control a three-, four- or five-motor five-speed crane from a remote position. The unit generates a unique sequence of tones called a command frame. The tones in this command frame are determined by the function on the crane the operator wishes to control. The command frame is generated continuously and transmitted on a single rf frequency in the 72-76 mc range.

Control transmitter units are available for controlling three-, four- or five-motor cranes. Auxiliary function switch kits are available for controlling other miscellaneous features of a crane. A complete list of auxiliary function switch kits and a model chart of the components included in each basic model are included in this section.

NOTE

> The last letter of a model number determines the position of the switch on the control transmitter unit. See Control Transmitter Auxiliary Function Switch Kits location and wiring detail.

The crane select kit permits the operator to select and control one of two or three cranes using a common control transmitter unit. A switch, located in one of the auxiliary switch positions, selects the address of the crane to be operated. The kit consists of a three-position switch with a cable and a plug for insertion into the address socket. The selected crane number is positioned over a pointer located below the switch knob. The address codes which correspond to the numbers on the knob are stamped on the plug connected to the address socket. The codes from top to bottom are Crane 1, Crane 2, and Crane 3. Refer to the Crane Select Kit Plug Detail of Figure 1.

CAUTION

> Be absolutely sure the desired crane has been selected before operating the control transmitter unit.

AUXILIARY FUNCTION SWITCH KITS

KIT MODEL	DESCRIPTION
CLN1005AA	Crane On-Off
CLN1006AA	Lights On-Off
CLN1007AA, AB, AC	Brake
CLN1008AA, AB	Operator Release
CLN1009AB	Hook Rotate
CLN1010AA	Hold On-Off
CLN1011AD	Magnet
CLN1012AD	Grapple
CLN1013AE*	Alarm
CLN1014AA, AC	Crane Select - 2
CLN1015AA, AC	Crane Select - 3
CLN1017AE*	Alarm/Reset
CLN1018AE*	Reset

*Identification Label Only

MOTOROLA

MODEL CHART
FOR
PORTABLE REMOTE CONTROL
CONTROL TRANSMITTER UNITS
72-76 MC

MODEL	DESCRIPTION
C1106B	THREE-MOTOR WITH ALARM, RESET, OR ALARM/RESET
C1108B	FOUR-MOTOR WITH ALARM, RESET, OR ALARM/RESET
C1110B	FIVE-MOTOR WITH ALARM, RESET, OR ALARM/RESET
C1174B*	CONTROL TRANSMITTER SPARE KIT

CODE:

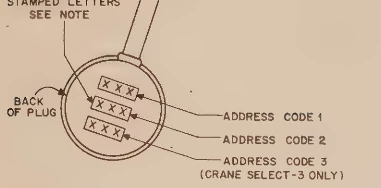
☒ = ONE ITEM SUPPLIED

⧄ = ONE ITEM SUPPLIED, EXCEPT WHEN REPLACED WITH CLN1014AA/AC OR CLN1015AA/AC

*REPLACEMENT KIT AVAILABLE.

ITEM	DESCRIPTION	C1106B	C1108B	C1110B	C1174B*
CLN6160A	SCANNER CIRCUIT BOARD	X	X	X	X
CLN6215A	LOW MULTI-FREQUENCY OSCILLATOR CIRCUIT BOARD	X	X	X	X
CLN6216A	HIGH MULTI-FREQUENCY OSCILLATOR CIRCUIT BOARD	X	X	X	X
NTC6010AA	TRANSMITTER CIRCUIT BOARD	X	X	X	X
NLC6000A	TRANSMITTER CRYSTAL KIT	X	X	X	
CLN6097A	NICKEL-CADMIUM BATTERY KIT	X	X	X	
CAC6000A	ANTENNA	X	X	X	
CLN6137A	THREE-MOTOR SWITCH KIT	X			
CLN6138A	FOUR-MOTOR SWITCH KIT		X	X	
CLN6124A	TRANSFER SWITCH KIT			X	
CLN6114A	ADDRESS PLUG KIT	⧄	⧄	⧄	
CHN6006A	HOUSING KIT	X	X	X	
CLN6161A	PANEL AND HARDWARE KIT	X	X	X	
CLN6095A	CARRYING HARNESS	X	X	X	
NLN6245A	TUNING TOOL KIT	X	X	X	
CLN6157A	MOTOR SWITCH KIT				X
CLN6183A*	PULL ON-PUSH OFF CRANE SWITCH KIT	X	X	X	
CLN6115A	LABEL KIT	X	X	X	

EPD-21833-O


STAMPED LETTERS
SEE NOTE
BACK OF PLUG
XXX
XXX
XXX
ADDRESS CODE 1
ADDRESS CODE 2
ADDRESS CODE 3
(CRANE SELECT-3 ONLY)
NOTE:
EACH ADDRESS CODE HAS THREE LETTERS.
AEPD-15258-0

Crane Select Kit Plug Detail

MODEL	DESCRIPTION
CLN6096A	Large Size Carrying Harness
NLN6480A	Battery Charger
NKN6111A	Battery Charger Cable Kit (for use with NLN6480A Battery Charger and battery)

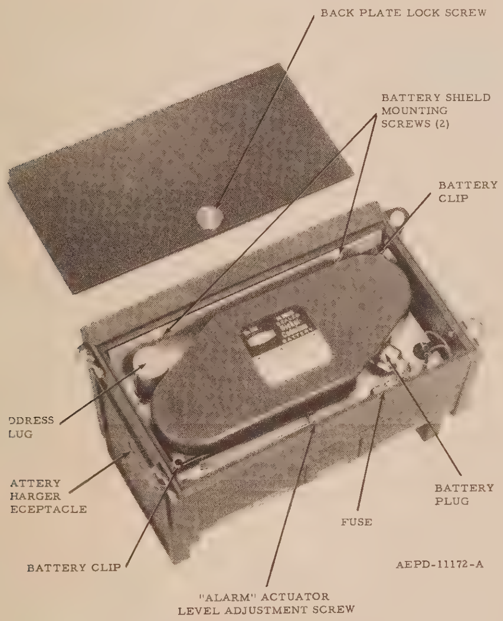

BACK PLATE LOCK SCREW
BATTERY SHIELD MOUNTING SCREWS (2)
BATTERY CLIP
DDRESS LUG
ATTERY HARGER ECEPTACLE
BATTERY CLIP
"ALARM" ACTUATOR LEVEL ADJUSTMENT SCREW
FUSE
BATTERY PLUG
AEPD-11172-A

Figure 1.
Control Transmitter Unit Battery Compartment

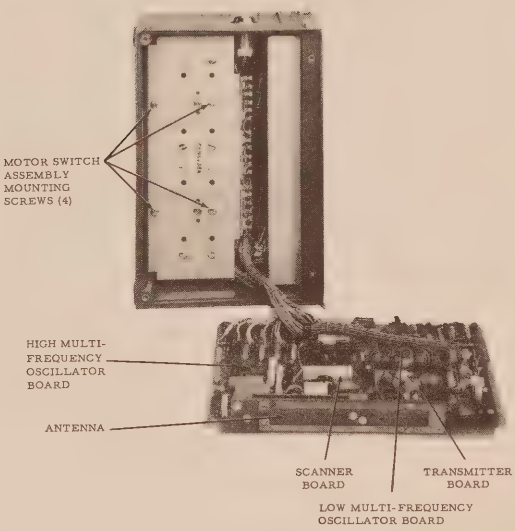

MOTOR SWITCH ASSEMBLY MOUNTING SCREWS (4)
HIGH MULTI-FREQUENCY OSCILLATOR BOARD
ANTENNA
SCANNER BOARD
TRANSMITTER BOARD
LOW MULTI-FREQUENCY OSCILLATOR BOARD

Figure 2.
Control Transmitter Unit With Circuit Boards Removed

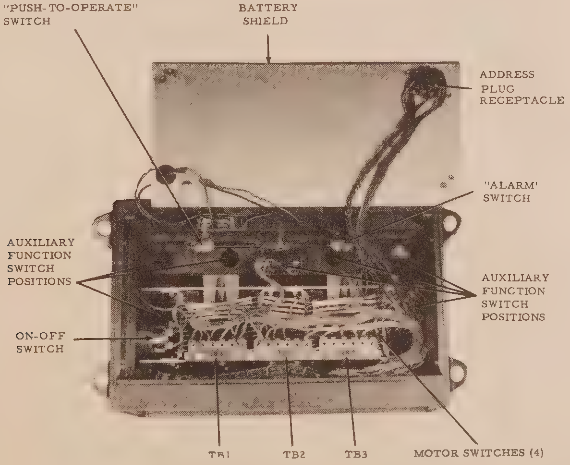

"PUSH-TO-OPERATE" SWITCH
BATTERY SHIELD
ADDRESS PLUG RECEPTACLE
"ALARM" SWITCH
AUXILIARY FUNCTION SWITCH POSITIONS
AUXILIARY FUNCTION SWITCH POSITIONS
ON-OFF SWITCH
TB1
TB2
TB3
MOTOR SWITCHES (4)

Figure 3.
Control Transmitter Unit with Battery Shield Removed

2. ENCODER

Refer to Control Transmitter and Encoder Unit Schematic Diagram.

The encoder is composed of three printed circuit boards. They are (1) CLN6160A Scanner, (2) CLN6215A Low Multi-Frequency Oscillator and (3) CLN6216A High Multi-Frequency Oscillator (MFO).

The basic timing of the transmitted tone pulses is controlled by the sequence generator which is part of the scanner board. The sequence generator is composed of an astable or free-running multivibrator (counter 1), or two bistable multivibrators (counters 2 and 3) and a series of eight AND gates.

The period of counter 1 is 40 milliseconds, thus it changes state once every 20 milliseconds. The output of one side of counter 1 is coupled to counter 2 which changes state once every 40 milliseconds. The output of counter 2 is coupled to counter 3 which changes state every 80 milliseconds. The eight AND gates are connected to the outputs of these counters in such a way that only one gate is actuated in a 20 millisecond period.

Each AND gate is actuated in sequence (i.e., time slots 1 through 8). After the eighth time slot output occurs, the first time slot begins again, starting a new time cycle every 160 milliseconds (eight 20 millisecond time slots).

The eight time slot outputs of the sequence generator are routed to the motor and auxiliary function switches and to the address plug. The outputs of the first three time slots are coupled to the address plug where they are routed to three of the six high frequency tone gates F_M through F_T. These three time slot outputs are also routed to low frequency tone gate F_G and, via the three auxiliary function switches, to low frequency gate F_F. The auxiliary function switches are SPST normally open switches. When these switches are off, gate F_G will be the only low tone gate actuated and tone F_G will be transmitted. If the auxiliary switch associated with a particular time slot is actuated, both gates F_F and F_G will be actuated. However, as will be described later, only tone F_F will be transmitted in the first three time slots. The sequence of three high frequency tones selected by the address plug together with either low frequency tone F_F or F_G determine the system address. The individual combinations of the high and low frequency tones in the first three time slots controls three unique auxiliary functions.

The outputs of time slots 4 through 7 are connected to low frequency tone gates F_E, F_D, F_C and F_B respectively, as well as to the common terminals of motor switches 1 through 4 (motor switch 4 is used only when the crane has an auxiliary hoist). These motor switches are 11-position rotary switches with a spring return-to-center position. Thus, they can control five speeds in either direction. The ten outputs of the motor switches associated with the speed and direction to be commanded are connected to the ten gate inputs of the high multi-frequency oscillator. Thus, a unique low frequency tone for each time slot plus a high frequency tone associated with a speed and direction command will be transmitted in time slots 4 through 7. If a motor switch is in the OFF position, the eleventh tone F_G (OFF) of the high frequency tone MFO and 1400 cps of the low frequency tone MFO is transmitted.

Time slot 8 is used for special auxilary functions such as magnet, grapple and hook rotate. The magnet or grapple function has a unique low frequency tone, F_M, which is actuated only on command. High frequency tones F_F (ON) and F_J (OFF) are used for control.

The high and low multi-frequency oscillators are similar in design and operation. The low MFO operates in the 490-1400 cps band and has seven tone gate inputs while the high MFO operates in the 1530-2830 cps band and has ten tone gate inputs.

Each MFO is essentially an astable or free-running multivibrator where the frequency is controlled by the voltage applied to the charging resistors in its base circuit. This voltage is controlled by a resistive voltage divider composed of a fixed resistor and the series string of resistors connected to the tone OR gates. When a tone gate is operated, it grounds the series resistor string at some point and establishes a voltage reference. The closer the resistor string grounding point is to the astable multivibrator, the lower the series resistance and reference voltage, and consequently the lower the tone frequency. If OR gates are operated simultaneously, the gate closest to the astable multivibrator determines the frequency. The audio output level of the MFO does not vary with frequency.

The outputs of the two MFO's are routed to an amplifier circuit which is located on the scanner board. The amplifier circuit matches the output impedance of the MFO to the input impedance of the transmitter modulator. This amplifier also has a frequency shaping network which has a 6 db per octave de-emphasis characteristic from 300 to 3000 cps. At frequencies above 3000 cps, the frequency shaping network sharply attenuates remaining audio components. This frequency shaping network is necessary since the transmitter used in this unit normally has a 6 db per octave pre-emphasis characteristic, and a constant deviation independent of frequency is required for the system. The output of the audio amplifier is then coupled to the modulator stage of the transmitter.

3. TRANSMITTER

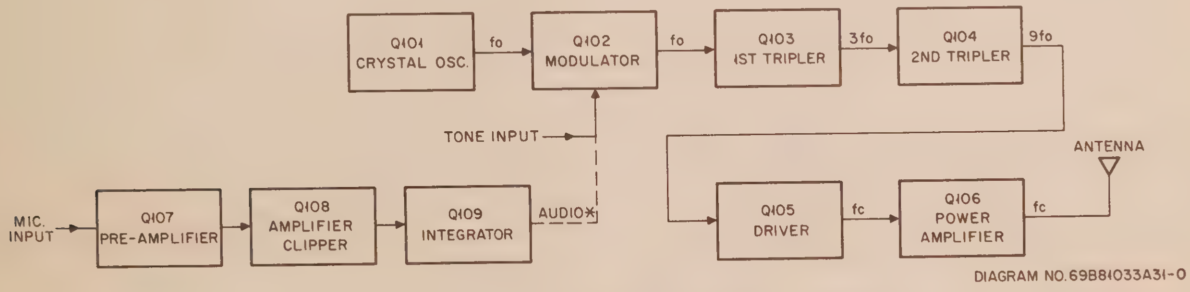
The transmitter is a phase-modulated crystal controlled transmitter used specifically for portable remote control systems operating in the 72-76 mc band. Refer to the Transmitter Block Diagram (Figure 4.) and the Transmitter Schematic Diagram for the following discussion.

The oscillator stage is crystal controlled and anti-resonant. Since the crystal is not heated, the circuit is temperature compensated for frequency stability over the entire temperature range. A variable "warp" capacitor across the crystal allows adjustment to the proper operating frequency. The oscillator operates on a specific frequency in the 8.0 to 8.444 mc range.

The output of the oscillator is applied to the base of the modulator transistor while a modulating signal (audio or tones) is applied to the emitter. With a fixed phase shift circuit shunting the modulator transistor and a variable phase shift through the transistor, an overall variable phase shift is obtained at the output. The variable reactance in the collector circuit of the modulator allows reactance matching to insure maximum linear deviation and minimum distortion.

From the modulator, the signal is first amplified, applied to a tripler, amplified again and then tripled once more to obtain the carrier frequency. The first tripler amplifier is forward biased to increase the gain of the stage since the signal input level is very low. The second tripler stage is operated class B. With drive present, this transistor will draw current which is easily monitored by measuring the dc voltage developed across the emitter resistor.

A driver stage follows to provide the proper amount of rf voltage to drive the power amplifier. The power amplifier output is coupled directly to the antenna.

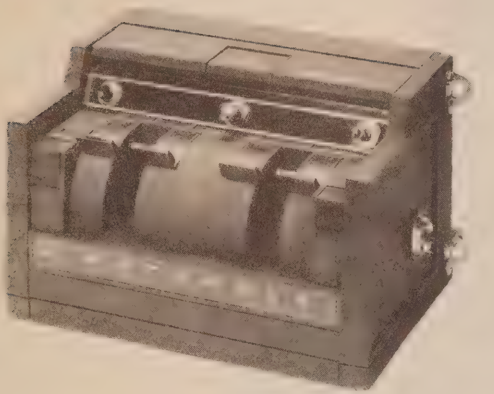


fo = OSCILLATOR FREQUENCY (8.0 - 8.444MC)
fc = CARRIER FREQUENCY 72-76 MC
$fo = \frac{fc}{9}$
✱ = AUDIO INPUT DISCONNECTED FOR TONE APPLICATIONS.

Figure 4.
Transmitter Block Diagram

CONTROL TRANSMITTER CIRCUIT BOARD AND SWITCH KIT

REPLACEMENT INSTRUCTIONS



MODEL TABLE

MODEL	DESCRIPTION
CLN6215A*	Low Multi-Frequency Oscillator Circuit Board
CLN6216A*	High Multi-Frequency Oscillator Circuit Board
CLN6160A*	Scanner Circuit Board
NTC6010AA*	Transmitter Circuit Board
CLN6157A*	Motor Switch Kit (Replaces switch 40C83782C01
CLN6158A	Magnet Switch Kit (Replaces switch 40C83327E01)
CLN6183A	PULL ON-PUSH OFF Crane Switch Kit (Replaces switch 40B82081F01)

*Part of C1174B Control Transmitter Replacement Kit.

1. APPLICATION

These instructions outline the procedure for replacing the major items used in the control transmitter unit of Motorola's Portable Remote Controls for Cranes. This procedure is applicable for the following control transmitter models:

CONTROL TRANSMITTER MODEL NUMBER	DESCRIPTION
C1106B	Three-Motor
C1108B	Four-Motor
C1110B	Five-Motor

2. PRELIMINARY INSTRUCTIONS

It is suggested that this procedure be read completely before beginning the replacement of item affected. The step-by-step disassembly and reassembly procedures should be followed as outlined.

NOTE

Use a soldering iron of 40 watts or less and do not apply excessive heat. Eyelets filled with solder can be opened by inserting a toothpick or other small instrument while the solder is flowing.

3. REPLACEMENT PROCEDURE

a. Model CLN6215A Low Multi-Frequency Oscillator Circuit Board

(1) Remove bottom plate and printed circuit board assembly as shown in Figure 1.

(2) Remove two mounting screws, nuts, lockwasher, cable clamp, and nylon insulators from oscillator circuit board (see Figure 2).

(3) Unsolder leads from circuit board starting with RED-WHT lead at right and

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CHICAGO, ILLINOIS 60651

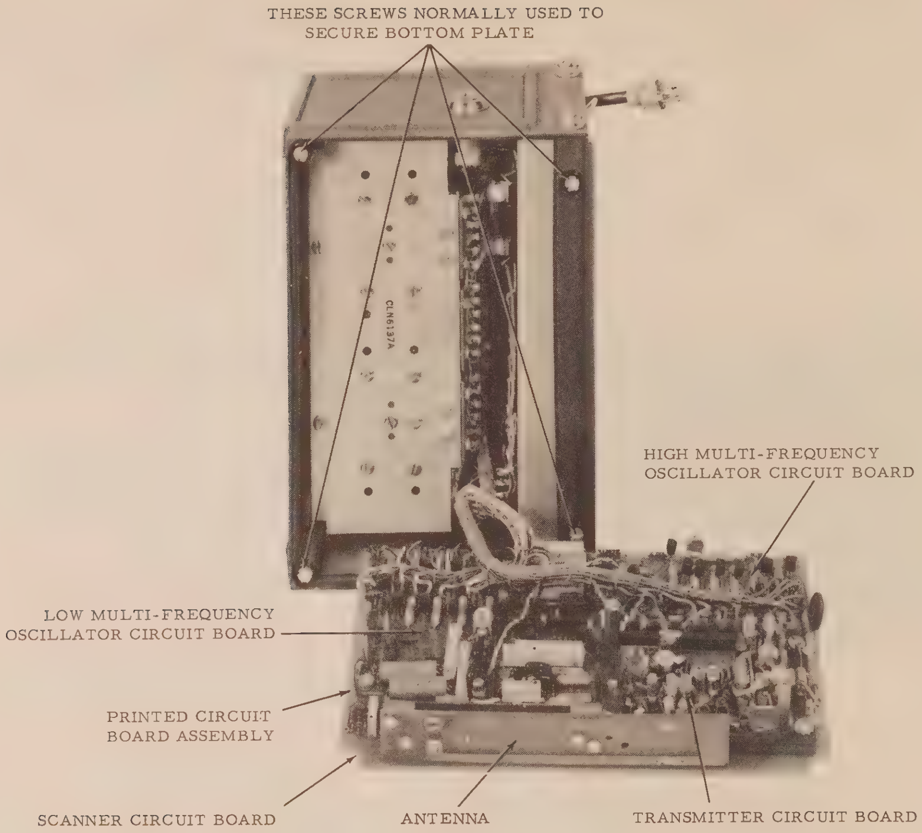

THESE SCREWS NORMALLY USED TO SECURE BOTTOM PLATE
CLN6137A
HIGH MULTI-FREQUENCY OSCILLATOR CIRCUIT BOARD
LOW MULTI-FREQUENCY OSCILLATOR CIRCUIT BOARD
PRINTED CIRCUIT BOARD ASSEMBLY
SCANNER CIRCUIT BOARD
ANTENNA
TRANSMITTER CIRCUIT BOARD

Figure 1.
Removal of Circuit Board Assembly

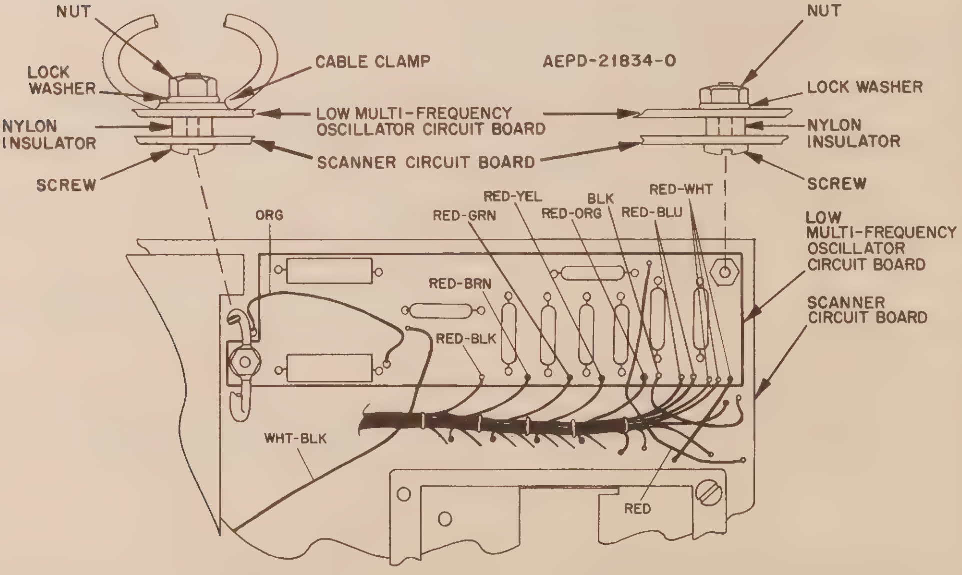

NUT
CABLE CLAMP
AEPD-21834-0
NUT
LOCK WASHER
LOCK WASHER
LOW MULTI-FREQUENCY OSCILLATOR CIRCUIT BOARD
NYLON INSULATOR
NYLON INSULATOR
SCANNER CIRCUIT BOARD
SCREW
SCREW
ORG
RED-GRN
RED-YEL
RED-ORG
BLK
RED-BLU
RED-WHT
LOW MULTI-FREQUENCY OSCILLATOR CIRCUIT BOARD
RED-BRN
RED-BLK
SCANNER CIRCUIT BOARD
WHT-BLK
RED

Figure 2.
Replacement of Low Multi-Frequency Oscillator Circuit Board

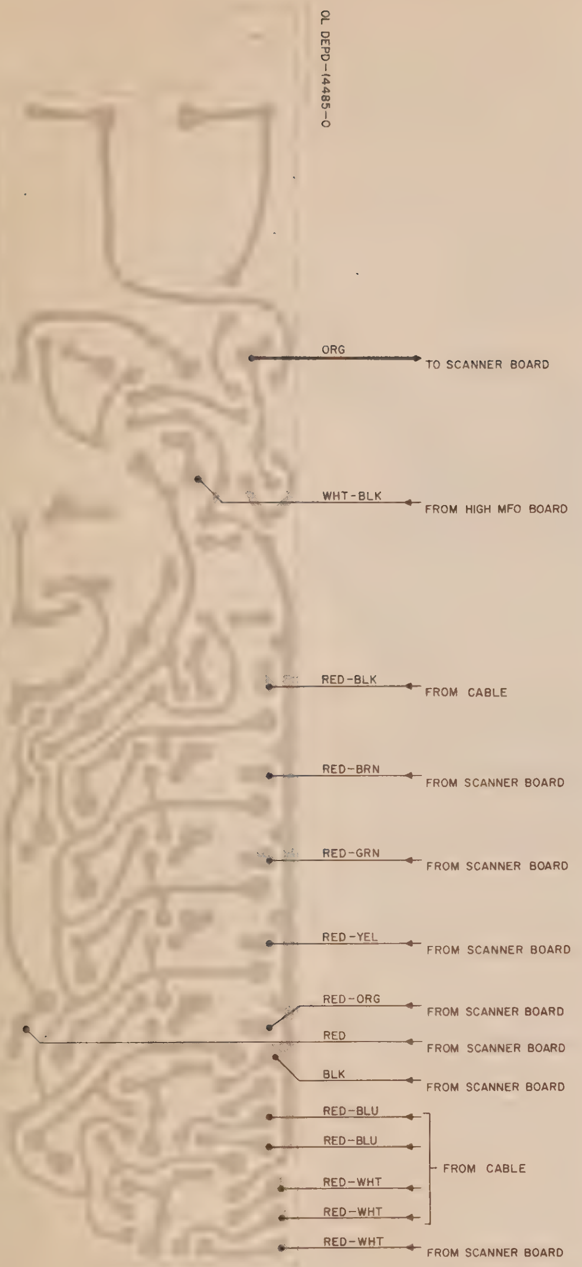

OL DEPD-14485-O
ORG
TO SCANNER BOARD
WHT-BLK
FROM HIGH MFO BOARD
RED-BLK
FROM CABLE
RED-BRN
FROM SCANNER BOARD
RED-GRN
FROM SCANNER BOARD
RED-YEL
FROM SCANNER BOARD
RED-ORG
FROM SCANNER BOARD
RED
FROM SCANNER BOARD
BLK
FROM SCANNER BOARD
RED-BLU
RED-BLU
FROM CABLE
RED-WHT
RED-WHT
RED-WHT
FROM SCANNER BOARD

Figure 3.
External Connections of Low Multifrequency Oscillator Circuit Board (Plating Side)

working left (see Figures 2 and 3). Remove board.

CAUTION

Do all soldering from plating side of circuit board and do not not apply excessive heat.

(4) Resolder leads to board starting with ORG lead at left and working right (see Figures 2 and 3).

(5) Mount new circuit board with screws, nuts, lockwasher, cable clamp, and nylon insulators previously removed. Make sure leads are not pinched when cable clamp mounting screw is tightened.

(6) Reassemble control transmitter by placing circuit board assembly back into housing and replacing bottom plate.

b. Model CLN6216A High Multi-Frequency Oscillator Circuit Board

(1) Remove bottom plate and printed circuit board assembly as shown in Figure 1.

(2) Remove two mounting screws, nuts, lockwasher, and nylon insulators from oscillator circuit board (see Figure 4).

(3) Unsolder RED and YEL jumpers from scanner board (see Figures 4 and 5).

CAUTION

Do all soldering from plating side of circuit board and do not apply excessive heat.

(4) Unsolder leads from circuit board starting with YEL-BLK lead at left and working right (see Figures 4 and 5). Remove board.

(5) Resolder leads to board starting with BLK jumper at right and work left (see Figures 4 and 5).

(6) Mount new circuit board with screws, nuts, lockwasher, and nylon insulators previously removed. Make sure leads are not pinched when mounting screws are tightened.

(7) Reassemble control transmitter by placing circuit board assembly back into housing and replacing bottom plate.

c. Model CLN6160A Scanner Circuit Board

(1) Remove bottom plate and printed circuit board assembly as shown in Figure 1.

(2) Unsolder leads, jumpers and chokes from scanner board starting with BLU-RED lead at right and working left (see Figure 6).

CAUTION

Do all soldering from plating side of circuit board and do not apply excessive heat.

(3) Remove high and low multi-frequency oscillator circuit boards, antenna, and transmitter circuit board by removing mounting screws, nuts, lockwasher, cable clamp, and nylon insulators (see Figures 2 and 4).

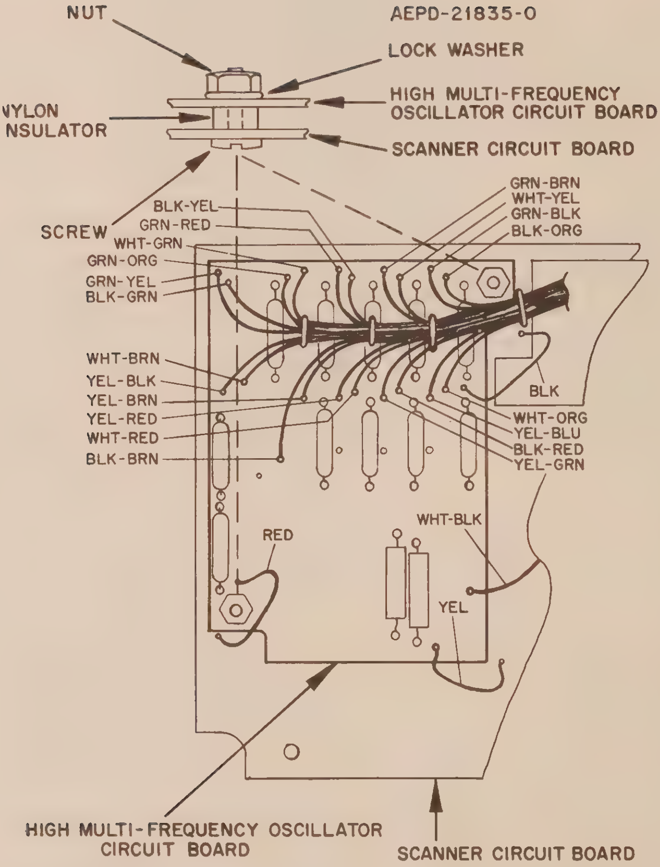

NUT
AEPD-21835-0
LOCK WASHER
HIGH MULTI-FREQUENCY OSCILLATOR CIRCUIT BOARD
NYLON INSULATOR
SCANNER CIRCUIT BOARD
SCREW
BLK-YEL
GRN-RED
WHT-GRN
GRN-ORG
GRN-YEL
BLK-GRN
GRN-BRN
WHT-YEL
GRN-BLK
BLK-ORG
WHT-BRN
YEL-BLK
YEL-BRN
YEL-RED
WHT-RED
BLK-BRN
BLK
WHT-ORG
YEL-BLU
BLK-RED
YEL-GRN
WHT-BLK
RED
YEL
HIGH MULTI-FREQUENCY OSCILLATOR CIRCUIT BOARD
SCANNER CIRCUIT BOARD

Figure 4.
Replacement of High Multi-Frequency Oscillator Circuit Board

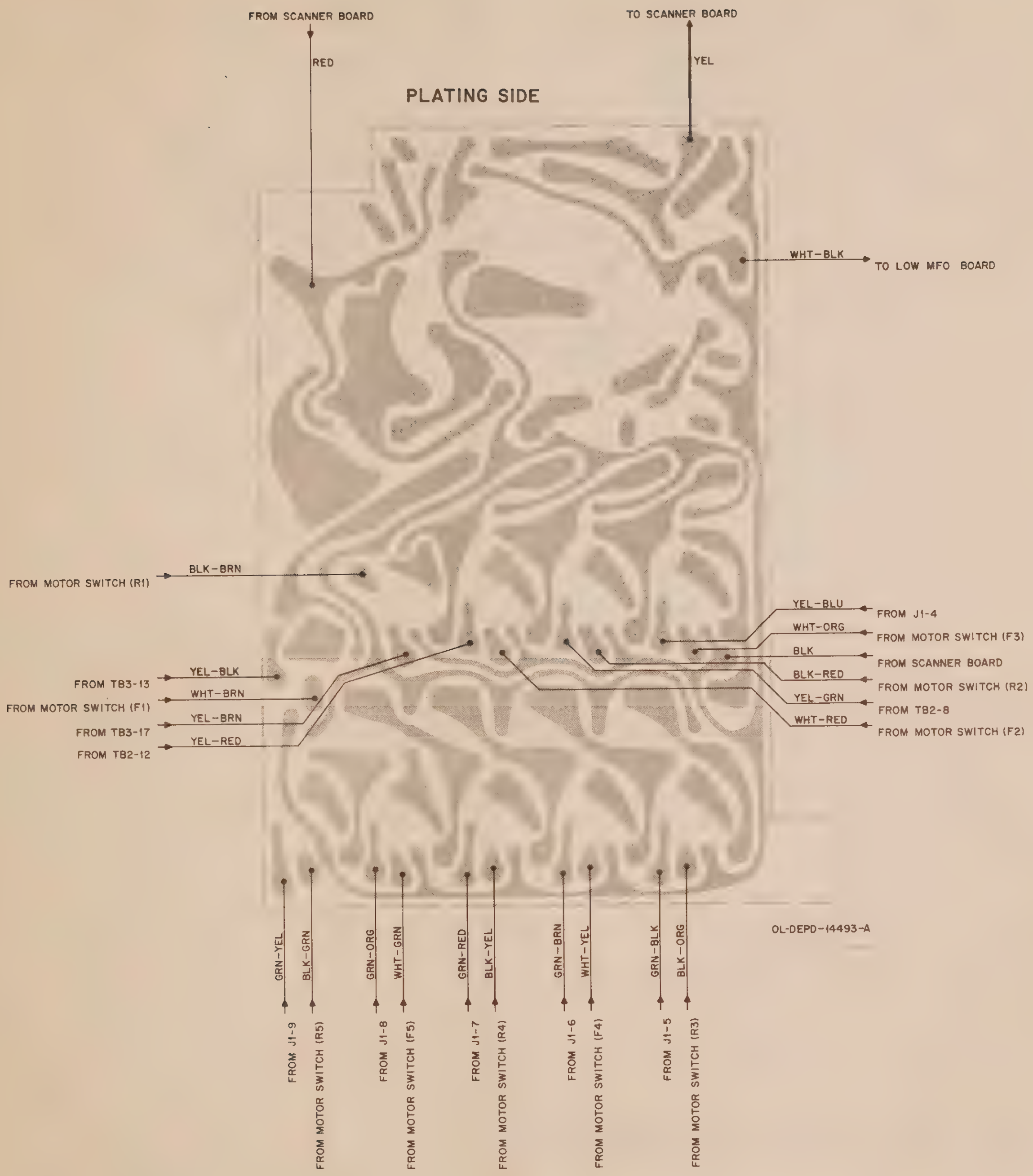

PLATING SIDE
FROM SCANNER BOARD
RED
TO SCANNER BOARD
YEL
WHT-BLK
TO LOW MFO BOARD
BLK-BRN
FROM MOTOR SWITCH (R1)
YEL-BLK
FROM TB3-13
WHT-BRN
FROM MOTOR SWITCH (F1)
YEL-BRN
FROM TB3-17
YEL-RED
FROM TB2-12
YEL-BLU
FROM J1-4
WHT-ORG
FROM MOTOR SWITCH (F3)
BLK
FROM SCANNER BOARD
BLK-RED
FROM MOTOR SWITCH (R2)
YEL-GRN
FROM TB2-8
WHT-RED
FROM MOTOR SWITCH (F2)
GRN-YEL
FROM J1-9
BLK-GRN
FROM MOTOR SWITCH (R5)
GRN-ORG
FROM J1-8
WHT-GRN
FROM MOTOR SWITCH (F5)
GRN-RED
FROM J1-7
BLK-YEL
FROM MOTOR SWITCH (R4)
GRN-BRN
FROM J1-6
WHT-YEL
FROM MOTOR SWITCH (F4)
GRN-BLK
FROM J1-5
BLK-ORG
FROM MOTOR SWITCH (R3)
OL-DEPD-14493-A

Figure 5.
External Connections of High Multi-Frequency Oscillator Circuit Board
(PLATING SIDE)

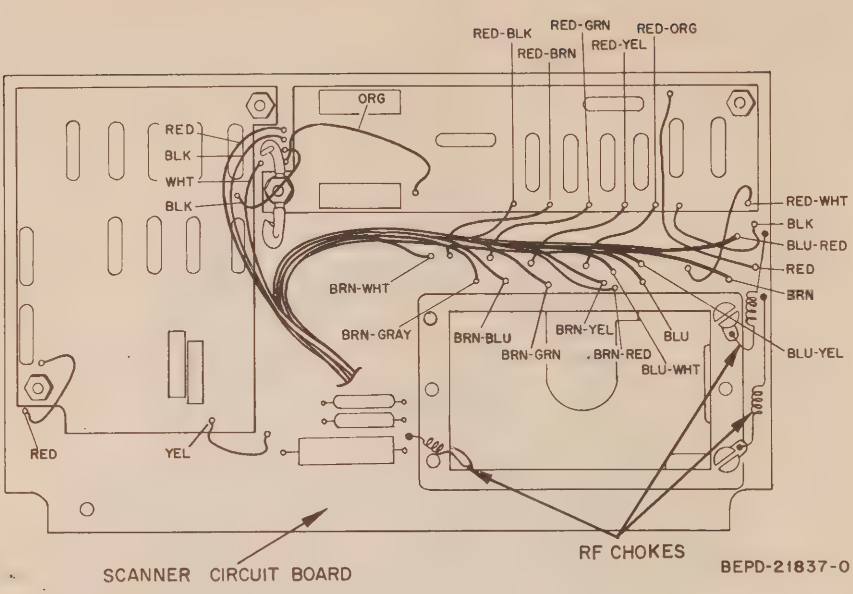

RED-BLK
RED-GRN
RED-ORG
RED-BRN
RED-YEL
ORG
RED
BLK
WHT
BLK
RED-WHT
BLK
BLU-RED
RED
BRN
BRN-WHT
BRN-GRAY
BRN-BLU
BRN-YEL
BLU
BRN-GRN
BRN-RED
BLU-WHT
BLU-YEL
RED
YEL
RF CHOKES
SCANNER CIRCUIT BOARD
BEPD-21837-0

Figure 6.
Replacement of Scanner Circuit Board

NOTE

The antenna and transmitter circuit board are interconnected with a cable.

(4) Fasten removed items in preceding step to new scanner board. Make sure cable and jumper leads are not twisted or pinched when cable clamp mounting screw is replaced and tightened.

(5) Resolder chokes, jumpers and leads to scanner board. Refer to Figures 6 and 7 for lead connecting information.

(6) Reassemble control transmitter by placing circuit board assembly back into housing and replacing bottom plate.

d. Model NTC6010AA Transmitter Circuit Board

(1) Remove bottom plate and printed circuit board assembly as shown in Figure 1.

(2) Unsolder RED and BLK leads, BLK antenna cable and choke from bottom side of transmitter circuit board (see Figure 8).

(3) Remove two screws securing transmitter circuit board.

(4) Remove board and replace with new one.

(5) Resolder leads, cable and choke to new board (see Figure 8).

(6) Reassemble control transmitter by placing circuit board assembly back into housing and replacing bottom plate.

e. Model CLN6157A Motor Switch Kit (replaces switch 40C83782C01)

(1) Remove Allen screws from motor switch paddles and pull paddles from switch shafts.

(2) Remove back plate and battery (see Figure 9).

(3) Remove two battery shield mounting screws and fold shield out and away from housing as shown in Figure 9.

(4) Remove six mounting screws from TB1, TB2 and TB3 (see Figure 10).

(5) Remove bottom plate and place printed circuit board assembly as shown in Figure 10.

(6) Remove four mounting screws from motor switch assembly (see Figure 9).

(7) Loosen switch assembly by pressing down on switch shafts from front of unit. Remove switch assembly from housing as shown in Figure 11.

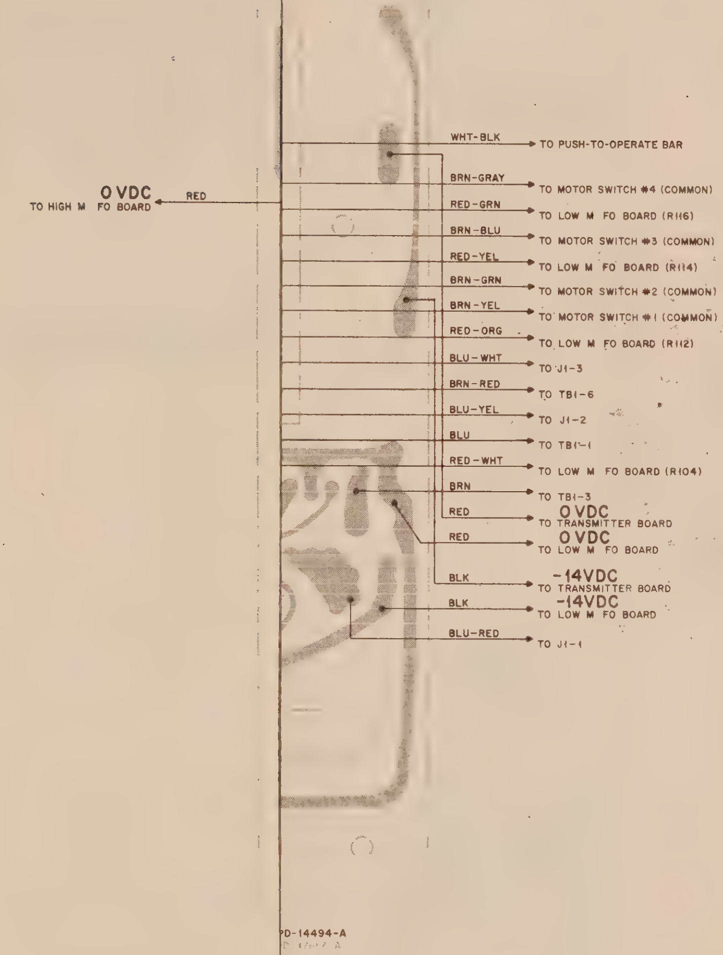

WHT-BLK
TO PUSH-TO-OPERATE BAR
0 VDC
TO HIGH M FO BOARD
RED
BRN-GRAY
TO MOTOR SWITCH #4 (COMMON)
RED-GRN
TO LOW M FO BOARD (R116)
BRN-BLU
TO MOTOR SWITCH #3 (COMMON)
RED-YEL
TO LOW M FO BOARD (R114)
BRN-GRN
TO MOTOR SWITCH #2 (COMMON)
BRN-YEL
TO MOTOR SWITCH #1 (COMMON)
RED-ORG
TO LOW M FO BOARD (R112)
BLU-WHT
TO J1-3
BRN-RED
TO TB1-6
BLU-YEL
TO J1-2
BLU
TO TB1-1
RED-WHT
TO LOW M FO BOARD (R104)
BRN
TO TB1-3
RED
0 VDC
TO TRANSMITTER BOARD
RED
0 VDC
TO LOW M FO BOARD
BLK
-14VDC
TO TRANSMITTER BOARD
BLK
-14VDC
TO LOW M FO BOARD
BLU-RED
TO J1-1
PD-14494-A

Figure 7.
Scanner Circuit Board
External Connection Detail
Motorola No. EPD-14495-A
8/28/68-RS

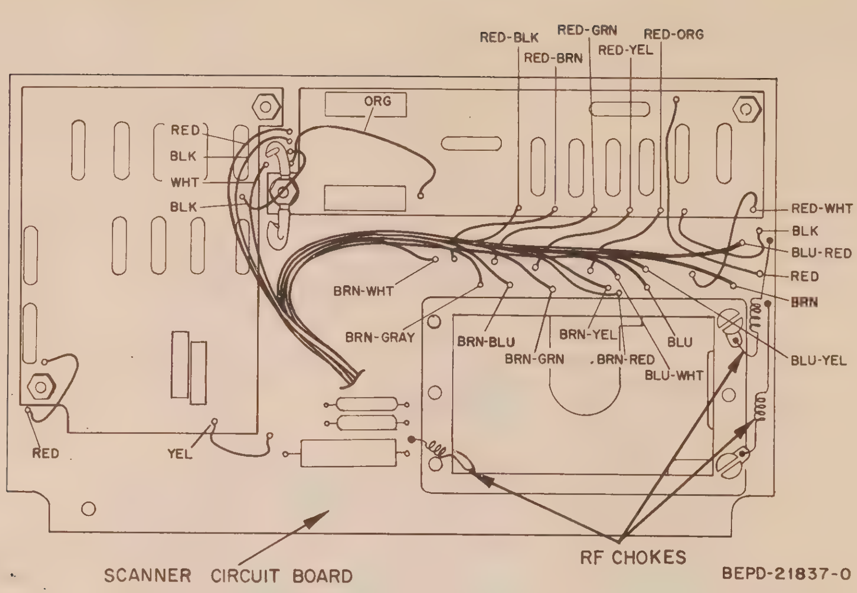

RED-BLK
RED-GRN
RED-ORG
RED-BRN
RED-YEL
ORG
RED
BLK
WHT
BLK
RED-WHT
BLK
BLU-RED
RED
BRN
BRN-WHT
BRN-GRAY
BRN-BLU
BRN-YEL
BLU
BRN-GRN
BRN-RED
BLU-WHT
BLU-YEL
RED
YEL
SCANNER CIRCUIT BOARD
RF CHOKES
BEPD-21837-0

Figure 6.
Replacement of Scanner Circuit Board

NOTE

The antenna and transmitter circuit board are interconnected with a cable.

(4) Fasten removed items in preceding step to new scanner board. Make sure cable and jumper leads are not twisted or pinched when cable clamp mounting screw is replaced and tightened.

(5) Resolder chokes, jumpers and leads to scanner board. Refer to Figures 6 and 7 for lead connecting information.

(6) Reassemble control transmitter by placing circuit board assembly back into housing and replacing bottom plate.

d. Model NTC6010AA Transmitter Circuit Board

(1) Remove bottom plate and printed circuit board assembly as shown in Figure 1.

(2) Unsolder RED and BLK leads, BLK antenna cable and choke from bottom side of transmitter circuit board (see Figure 8).

(3) Remove two screws securing transmitter circuit board.

(4) Remove board and replace with new one.

(5) Resolder leads, cable and choke to new board (see Figure 8).

(6) Reassemble control transmitter by placing circuit board assembly back into housing and replacing bottom plate.

e. Model CLN6157A Motor Switch Kit (replaces switch 40C83782C01)

(1) Remove Allen screws from motor switch paddles and pull paddles from switch shafts.

(2) Remove back plate and battery (see Figure 9).

(3) Remove two battery shield mounting screws and fold shield out and away from housing as shown in Figure 9.

(4) Remove six mounting screws from TB1, TB2 and TB3 (see Figure 10).

(5) Remove bottom plate and place printed circuit board assembly as shown in Figure 10.

(6) Remove four mounting screws from motor switch assembly (see Figure 9).

(7) Loosen switch assembly by pressing down on switch shafts from front of unit. Remove switch assembly from housing as shown in Figure 11.

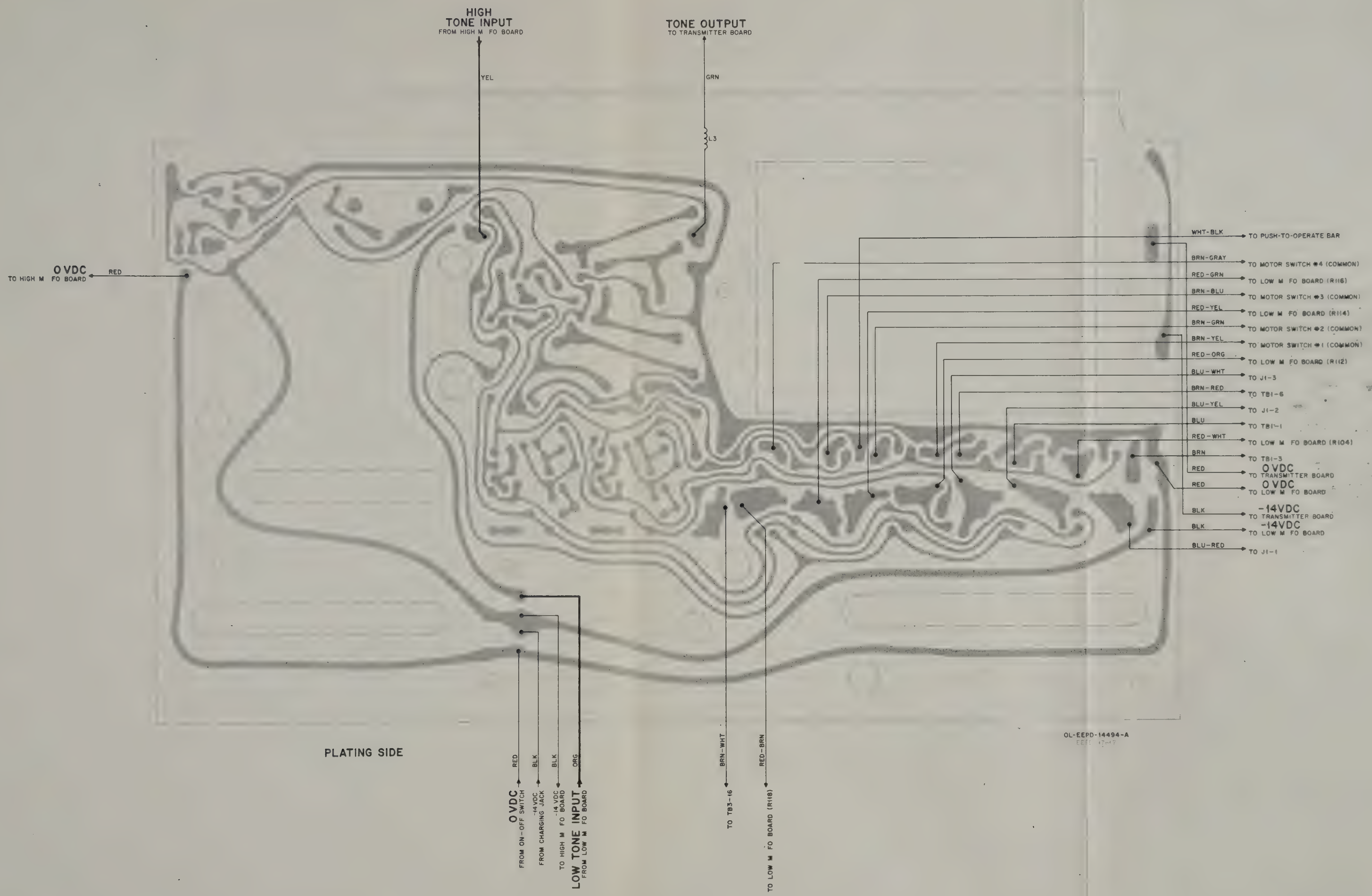
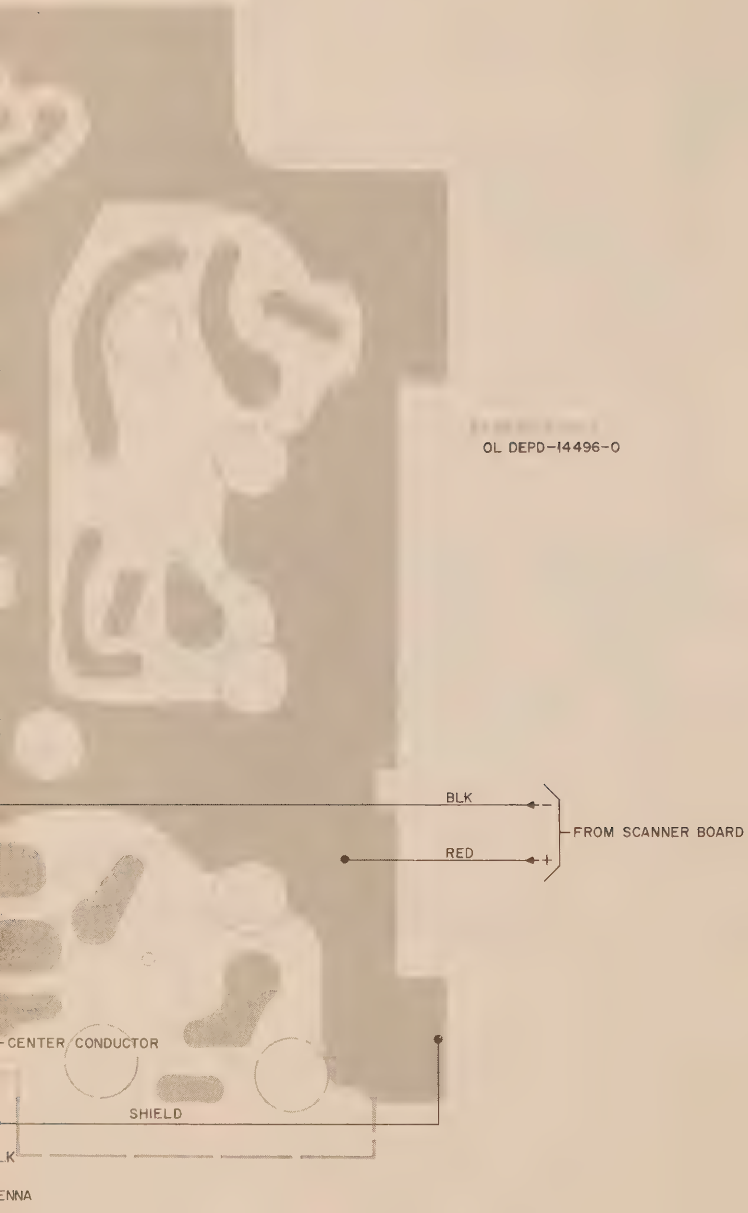

HIGH
TONE INPUT
FROM HIGH M FO BOARD
YEL
TONE OUTPUT
TO TRANSMITTER BOARD
GRN
L3
0 VDC
TO HIGH M FO BOARD
RED
WHT-BLK
TO PUSH-TO-OPERATE BAR
BRN-GRAY
TO MOTOR SWITCH #4 (COMMON)
RED-GRN
TO LOW M FO BOARD (R116)
BRN-BLU
TO MOTOR SWITCH #3 (COMMON)
RED-YEL
TO LOW M FO BOARD (R114)
BRN-GRN
TO MOTOR SWITCH #2 (COMMON)
BRN-YEL
TO MOTOR SWITCH #1 (COMMON)
RED-ORG
TO LOW M FO BOARD (R112)
BLU-WHT
TO J1-3
BRN-RED
TO TB1-6
BLU-YEL
TO J1-2
BLU
TO TB1-1
RED-WHT
TO LOW M FO BOARD (R104)
BRN
TO TB1-3
RED
0 VDC
TO TRANSMITTER BOARD
RED
0 VDC
TO LOW M FO BOARD
BLK
-14VDC
TO TRANSMITTER BOARD
BLK
-14VDC
TO LOW M FO BOARD
BLU-RED
TO J1-1
OL-EEPD-14494-A
PLATING SIDE
RED
0 VDC
FROM ON-OFF SWITCH
BLK
-14 VDC
FROM CHARGING JACK
BLK
-14 VDC
TO HIGH M FO BOARD
ORG
LOW TONE INPUT
FROM LOW M FO BOARD
BRN-WHT
TO TB3-16
RED-BRN
TO LOW M FO BOARD (R118)

Figure 7.
Scanner Circuit Board
External Connection Detail
Motorola No. EPD-14495-A
8/28/68-RS


BLK
RED
FROM SCANNER BOARD
CENTER CONDUCTOR
SHIELD
LK
ENNA

OL DEPD-14496-0

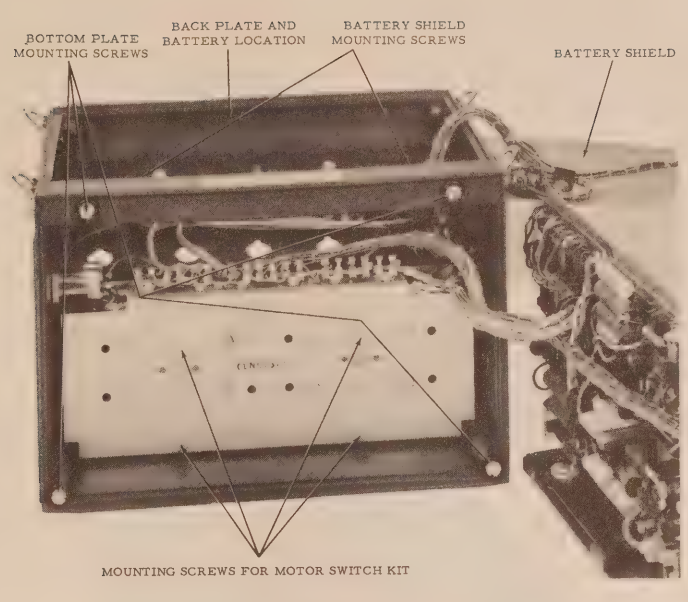

BOTTOM PLATE MOUNTING SCREWS
BACK PLATE AND BATTERY LOCATION
BATTERY SHIELD MOUNTING SCREWS
BATTERY SHIELD
MOUNTING SCREWS FOR MOTOR SWITCH KIT

Figure 9.
Battery Shield Removal

CAUTION

If magnet switches are used with control transmitter, make sure cables going to the switches (shown in Figure 10) are not damaged when motor switch assembly is removed.

(8) Remove top support plate from switch assembly.

(9) Loosen switch assembly as required to gain access to switch.

(10) Before unsoldering leads from switch, make sure it is defective by checking arm-to-contact circuit with an ohmmeter.

(11) Unsolder leads from switch starting from top contact and working down. DO NOT CUT LEADS.

CAUTION

Be careful not to damage nylon insulators on switch assembly screws when soldering switch leads.

(12) Resolder leads to switch starting with bottom contact and working up. Make sure lead color and switch contact scheme is same on all switches. Use any other switch as a guide when resoldering leads to new switch.

NOTE

If auxiliary hoist motor switch is replaced, RED-BLK lead is connected to switch with two BLK leads.

(13) Fasten new switch to base mounting plate. Do not tighten screws at this time.

(14) Align shafts of switches using alignment clip provided. Tighten screws on base mounting plate.

(15) Replace top support plate on switch assembly. Align switches vertically before tightening screws.

(16) Reassemble control transmitter by reversing steps (1) through (7). Check unit to make sure all screws are tight.

f. Models CLN6158A Magnet Switch Kit And CLN6157A Motor Switch Kit

(1) Remove Allen screws from motor switch paddles and pull paddles from switch shafts.

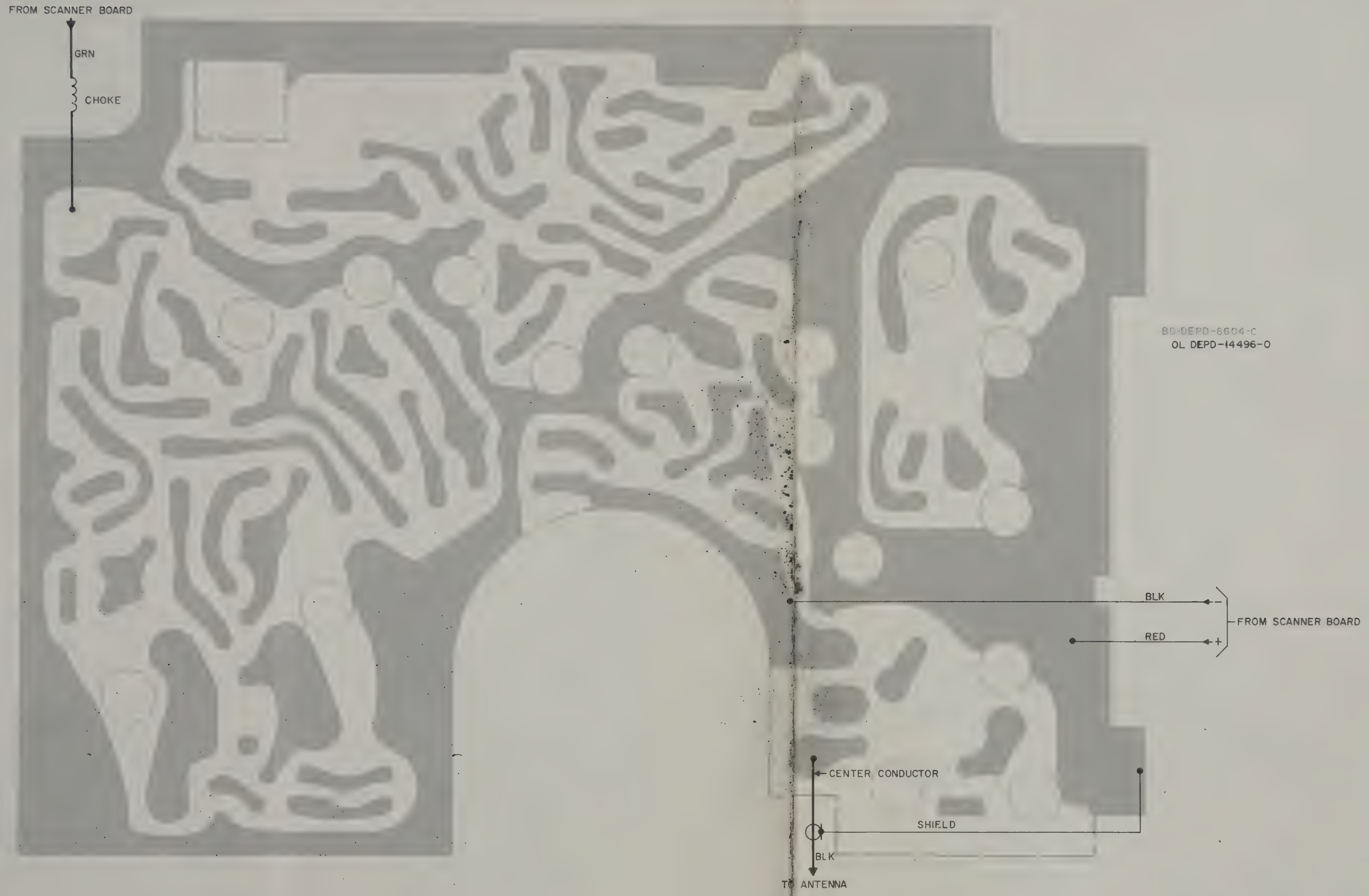

FROM SCANNER BOARD
GRN
CHOKE
BD-DEPD-8604-C
OL DEPD-14496-0
BLK
−
FROM SCANNER BOARD
RED
+
CENTER CONDUCTOR
SHIELD
BLK
TO ANTENNA

Figure 8.
Transmitter Circuit Board
External Connection Detail
Motorola No. EPD-15159-O
8/28/68-RS

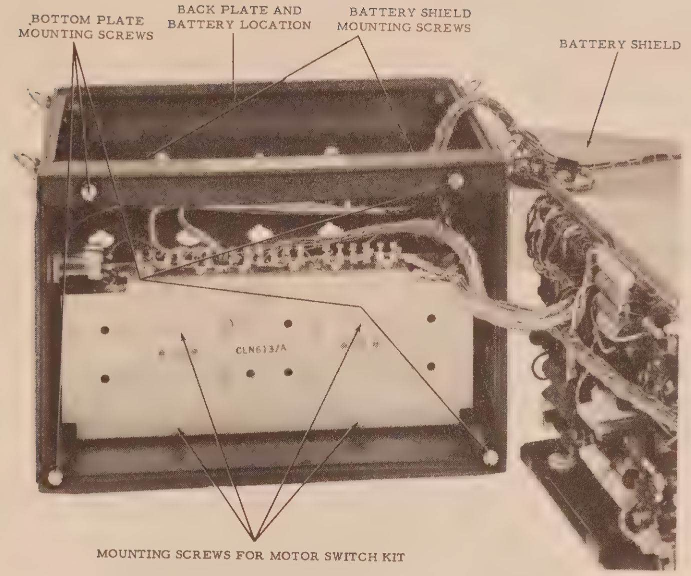

BOTTOM PLATE MOUNTING SCREWS
BACK PLATE AND BATTERY LOCATION
BATTERY SHIELD MOUNTING SCREWS
BATTERY SHIELD
CLN6137A
MOUNTING SCREWS FOR MOTOR SWITCH KIT

Figure 9.
Battery Shield Removal

CAUTION

> If magnet switches are used with control transmitter, make sure cables going to the switches (shown in Figure 10) are not damaged when motor switch assembly is removed.

(8) Remove top support plate from switch assembly.

(9) Loosen switch assembly as required to gain access to switch.

(10) Before unsoldering leads from switch, make sure it is defective by checking arm-to-contact circuit with an ohmmeter.

(11) Unsolder leads from switch starting from top contact and working down. DO NOT CUT LEADS.

CAUTION

> Be careful not to damage nylon insulators on switch assembly screws when soldering switch leads.

(12) Resolder leads to switch starting with bottom contact and working up. Make sure lead color and switch contact scheme is same on all switches. Use any other switch as a guide when resoldering leads to new switch.

NOTE

> If auxiliary hoist motor switch is replaced, RED-BLK lead is connected to switch with two BLK leads.

(13) Fasten new switch to base mounting plate. Do not tighten screws at this time.

(14) Align shafts of switches using alignment clip provided. Tighten screws on base mounting plate.

(15) Replace top support plate on switch assembly. Align switches vertically before tightening screws.

(16) Reassemble control transmitter by reversing steps (1) through (7). Check unit to make sure all screws are tight.

f. Models CLN6158A Magnet Switch Kit And CLN6157A Motor Switch Kit

(1) Remove Allen screws from motor switch paddles and pull paddles from switch shafts.

(2) Remove back plate and battery (see Figure 9).

(3) Remove two battery shield mounting screws and fold shield out and away from housing as shown in Figure 9.

(4) Remove six mounting screws from TB1, TB2 and TB3 (see Figure 10).

(5) Remove bottom cover and place printed circuit board assembly as shown in Figure 10.

(6) Remove four mounting screws from motor switch assembly (see Figure 9).

(7) Loosen switch assembly by pressing down on the switch shafts from front of unit. Remove switch assembly from housing as shown in Figure 11.

CAUTION

Make sure that cables going to switches (shown in Figure 10) are not damaged when motor switch assembly is removed.

(8) Cut leads as close to switch as possible.

(9) Strip back about 1/8" of insulation from lead end and tin.

(10) Remove defective switch by turning counterclockwise and replacing with new switch.

(11) Solder leads to switch as shown in Figure 12.

(12) Reassemble control transmitter by reversing steps (1) through (7).

NOTE

Check the control transmitter for broken or pinched leads before proceeding to next step in assembly.

g. Model CLN6183A Pull On-Push Off Crane Switch Kit (Replaces switch 40B82081F01)

(1) Remove back plate and battery (see Figure 9).

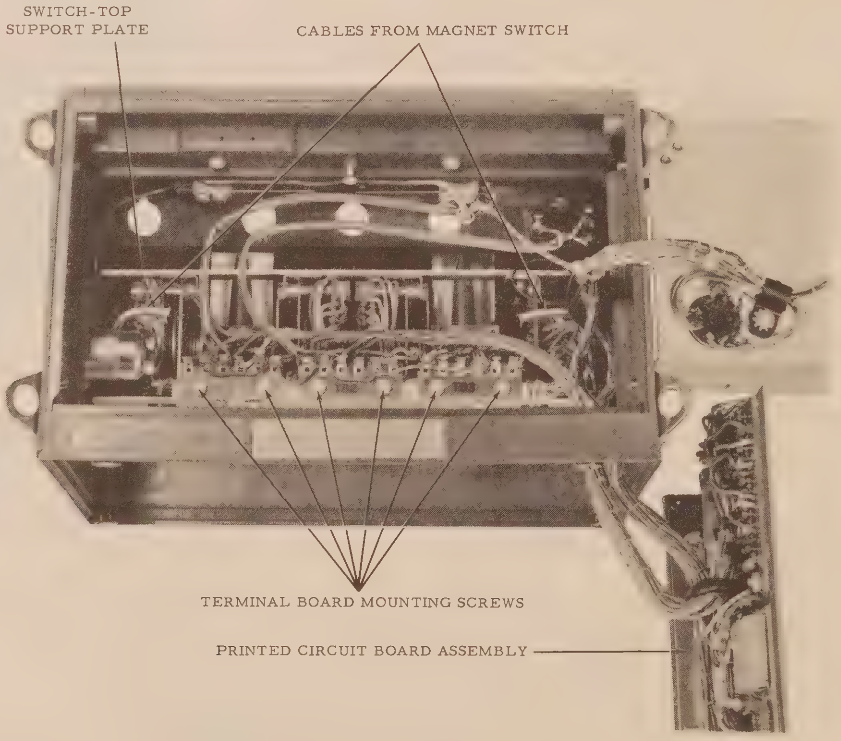

SWITCH-TOP SUPPORT PLATE
CABLES FROM MAGNET SWITCH
TERMINAL BOARD MOUNTING SCREWS
PRINTED CIRCUIT BOARD ASSEMBLY

Figure 10.
Terminal Board Removal

(2) Remove two battery shield mounting screws and fold shield out and away from housing as shown in Figure 9.

(3) Unsolder leads.

(4) Remove switch from housing and replace with new switch.

(5) Resolder leads to new switch.

(6) Reassembly control transmitter.

4. CHECKOUT PROCEDURE

Check control transmitter for proper operation using the Motorola C1170A Portable Remote Control Test Set. If the test set is not available, the unit may be checked out by following the procedure outlined in the troubleshooting chart of the instruction manual supplied with the portable remote control equipment.

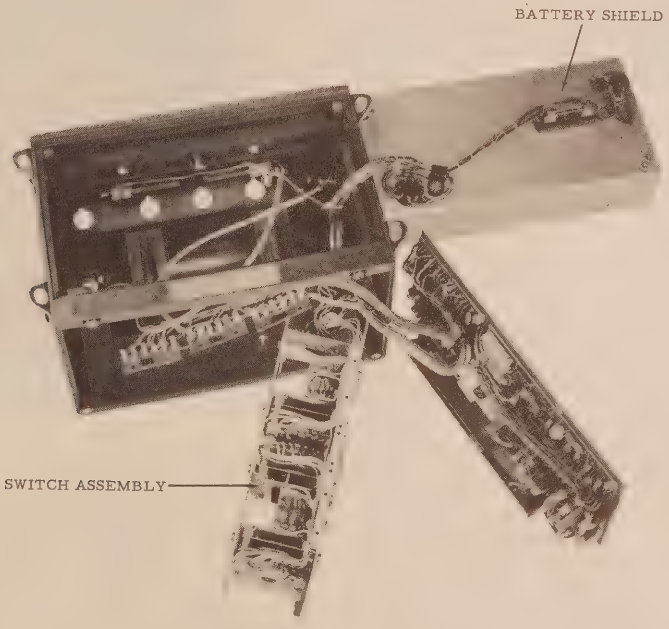
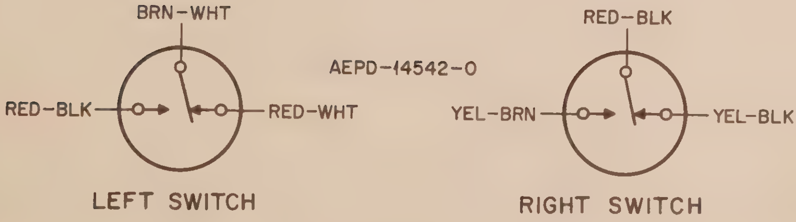

BATTERY SHIELD
SWITCH ASSEMBLY

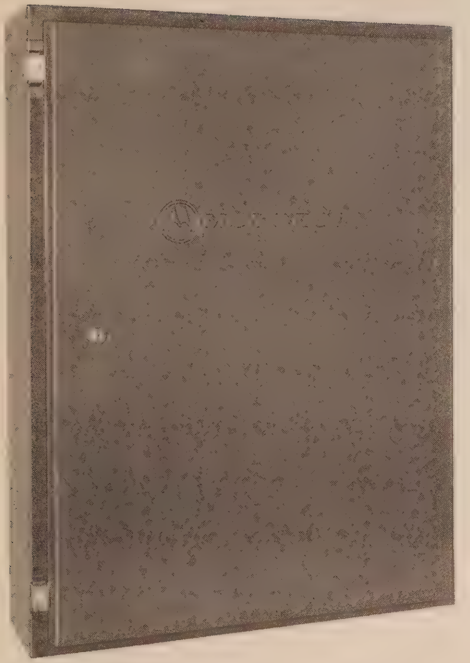
Figure 11.
Switch Assembly Removal


BRN-WHT
RED-BLK
RED-WHT
LEFT SWITCH
AEPD-14542-0
RED-BLK
YEL-BRN
YEL-BLK
RIGHT SWITCH

(BOTTOM VIEW)

Figure 12.
Magnet Switch Lead Connections

RECEIVER-DECODER UNIT



MODEL	DESCRIPTION
C1120B, C	THREE-MOTOR CRANES
C1121B, C	FOUR- AND FIVE-MOTOR CRANES
C1124A B*	THREE-MOTOR CRANES WITH OPERATOR RELEASE OPTION
C1125A, B*	FOUR- AND FIVE-MOTOR CRANES WITH OPERATOR RELEASE OPTION

*2-Frequency Models

1. GENERAL DESCRIPTION

The receiver-decoder unit responds to commands initiated by the control transmitter unit. It receives and decodes these commands to produce contact closures in an interface relay group which in turn actuate the crane motor control contactors.

ACCESSORY KIT

MODEL	DESCRIPTION
CAC6010A	Antenna

The receiver-decoder unit is comprised of a 72-76 mc one or two-frequency receiver, tone decoders and verifier circuits, and function decoder circuits mounted on a single plate. The unit is housed in a moisture and dust resistant cabinet which has a keylocked front door. Models are available for controlling three-four or five-motor cranes. The components included in each basic model are listed in the Model Chart.

2. RECEIVER

The receiver is a completely transistorized double-conversion superheterodyne type. It receives FM signals on a fixed, crystal-controlled frequency in the 72-76 mc band. Refer to the Receiver Block Diagram (Figure 2) and the Receiver Schematic Diagram for the following discussion.

a. RF Amplifier

The r-f section of the receiver consists of six highly selective tuned circuits and a neutralized common emitter r-f amplifier stage.

Signals received at the antenna are coupled to the base of the r-f amplifier through a selective triple-tuned circuit. The output of the r-f amplifier is coupled to the first mixer through a second selective triple-tuned circuit. The gain of this stage provides an optimum signal-to-noise ratio for the received signal.

b. First Oscillator - Multiplier

The first oscillator circuitry is housed in a factory-sealed, temperature-compensated plug-in module (channel element). The oscillator uses an unheated crystal operating on its fundamental mode

MOTOROLA

MODEL CHART

FOR

PORTABLE REMOTE CONTROL

RECEIVER-DECODER UNITS AND CABINETS

72-76 MC

CODE:

X = ONE ITEM SUPPLIED

2 = NUMBER OF ITEMS SUPPLIED

*REPLACEMENT KIT AVAILABLE.

ITEM	DESCRIPTION	C1120B THREE-MOTOR RECEIVER-DECODER UNIT	C1121B FOUR OR FIVE-MOTOR RECEIVER-DECODER UNIT	C1130A CABINET	C1124A THREE-MOTOR RECEIVER-DECODER UNIT (WITH OPERATOR RELEASE)	C1125A FOUR OR FIVE-MOTOR RCVR-DECODER UNIT (WITH OPERATOR RELEASE)	*C1172A RECEIVER-DECODER KIT	*C1175A RECEIVER-DECODER KIT (WITH OPERATOR RELEASE)	C1120C THREE-MOTOR RECEIVER-DECODER UNIT	C1121C FOUR OR FIVE-MOTOR RECEIVER-DECODER UNIT	C1124B (2-freq) THREE-MOTOR RECEIVER-DECODER UNIT (WITHOPERATOR RELEASE)	C1125B (2-freq) FOUR OR FIVE-MOTOR RCVR-DECODER UNIT (WITH OPERATOR RELEASE)
CRC1000AB	RECEIVER	X	X		X	X						
TLN1081A	CHANNEL ELEMENT, RECEIVER								X	X	2	2
CLN1002B	DRIVER-LIMITER & FILTER KIT	X	X		X	X			X	X		
CLN1004B	TONE FILTER PANEL	X	X		X	X			X	X		
CLN6091B	LOW FREQUENCY TONE DECODER CIRCUIT BOARD	X	X		X	X	X	X	X	X		
CLN6090B	HIGH FREQUENCY TONE DECODER CIRCUIT BOARD	X	X		X	X	X	X	X	X		
CLN6083B	ADDRESS VERIFIER CIRCUIT BOARD	X	X				X		X	X		
CLN6082B	SEQUENCE VERIFIER CIRCUIT BOARD	X	X		X	X	X	X	X	X		
CLN6094B	MOTOR FUNCTION DECODER CIRCUIT BOARD	3	4		3	4	X	X	3	4		
CLN1040A	DIODE MATRIX CIRCUIT BOARD	X	2		X	2	X	X	X	2		
CLN6093A	RELAY DRIVER CIRCUIT BOARD	2	2		2	2	X	X	2	2		
TLN1020A	CHANNEL ELEMENT, RECEIVER	X	X		X	X						
CRC1000BB	RECEIVER, 1-FREQUENCY								X	X		
CRC1000BC	RECEIVER, 2-FREQUENCY										X	X
G09	CRYSTAL, RECEIVER IF	X	X		X	X						
CLN6118B	CHASSIS MOUNTING PLATE	X	X		X	X			X	X		
CLN6119B	EXPANSION DECK (SECOND DECK)		X			X				X		
TLN6845A	TUNING TOOL KIT	X	X		X	X			X	X		
CLN6114A	ADDRESS PLUG KIT	X	X						X	X		
CLN6084B	AUXILIARY FUNCTION DECODER BOARD	X	X		X	X	X	X	X	X		
CLN6132B	JUMPER PLUG KIT	X			X				X			
CLN6117A	CABINET ACCESSORY KIT	X	X		X	X			X	X		
CHN6012A	CABINET KIT			X								
CKN6013A	JUMPER CABLE KIT			X								
CLN6167A	OPERATOR RELEASE KIT				X	X		X				
CLN6151B	AUTOMATIC SAFETY OVERRIDE CIRCUIT BOARD	X	X		X	X	X	X	X	X		
CLN6153A	TWO-ADDRESS PLUG KIT				X	X						
*CLN6099B	DRIVER-LIMITER KIT						X	X				

EPD-17496-A

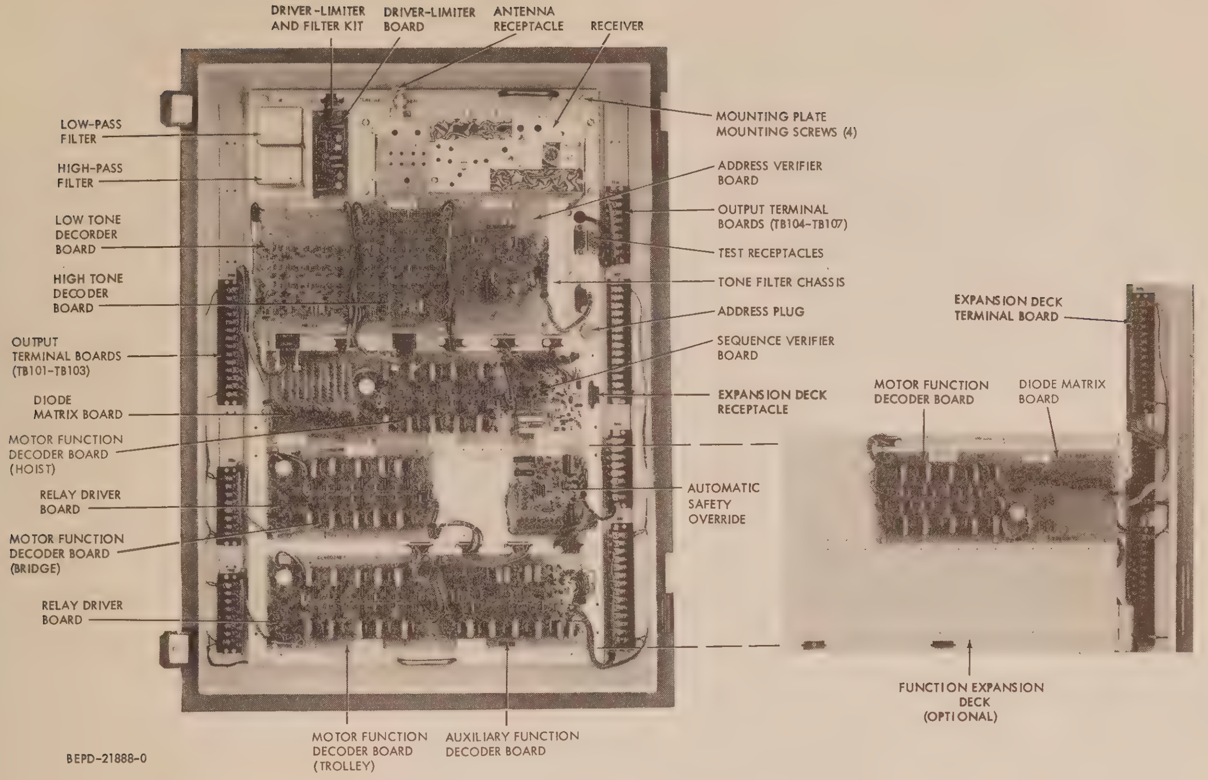

DRIVER-LIMITER AND FILTER KIT
DRIVER-LIMITER BOARD
ANTENNA RECEPTACLE
RECEIVER
MOUNTING PLATE MOUNTING SCREWS (4)
ADDRESS VERIFIER BOARD
OUTPUT TERMINAL BOARDS (TB104-TB107)
TEST RECEPTACLES
TONE FILTER CHASSIS
ADDRESS PLUG
SEQUENCE VERIFIER BOARD
EXPANSION DECK RECEPTACLE
AUTOMATIC SAFETY OVERRIDE
LOW-PASS FILTER
HIGH-PASS FILTER
LOW TONE DECORDER BOARD
HIGH TONE DECODER BOARD
OUTPUT TERMINAL BOARDS (TB101-TB103)
DIODE MATRIX BOARD
MOTOR FUNCTION DECODER BOARD (HOIST)
RELAY DRIVER BOARD
MOTOR FUNCTION DECODER BOARD (BRIDGE)
RELAY DRIVER BOARD
MOTOR FUNCTION DECODER BOARD (TROLLEY)
AUXILIARY FUNCTION DECODER BOARD
EXPANSION DECK TERMINAL BOARD
MOTOR FUNCTION DECODER BOARD
DIODE MATRIX BOARD
FUNCTION EXPANSION DECK (OPTIONAL)
BEPD-21888-0

Figure 1.
Receiver-Decoder Unit Parts Location Detail

in a Colpitts circuit with the output tuned to the third harmonic of the crystal frequency. This signal is then applied to a transistorized circuit which multiplies the frequency two times. Consequently the injection signal to the first mixer is six times the fundamental frequency of the crystal. In the two-frequency receiver model only, only one of the channel elements (F2) is used. The selection of the proper channel element is made by the automatic frequency select kit. The kit grounds the appropriate channel element control wire thus turning on its oscillator circuit.

c. First Mixer

The first mixer heterodynes the signal from the r-f amplifier with the signals from the first oscillator to produce the first intermediate-frequency (1st i-f) of 8 mc.

These frequency relationships can be expressed as follows:

$$\underbrace{6}_{\text{multi. factor}}\underbrace{f_o}_{\text{crystal freq.}} - \underbrace{f_c}_{\text{r-f carrier input}} = \underbrace{8 \text{ mc}}_{\text{1st mixer output (1st i-f)}}$$

$$f_o = \frac{f_c + 8 \text{ mc}}{6}$$

The first mixer is a low noise transistor and produces a power gain.

d. First IF and Second Mixer

The first i-f consists of a common emitter amplifier stage and five tuned circuits. The output of the first mixer is coupled to the base of the 8 mc amplifier through a selective double-tuned circuit.

The output of the 8 mc amplifier is coupled to the base of the second mixer through a highly selective triple-tuned circuit. Also applied to the base of the second mixer is the injection frequency of the second oscillator. The second oscillator frequency is controlled by an 8.455 mc crystal. The frequency of the second oscillator and the 8 mc frequency of the first i-f is maintained constant for all incoming signals at the antenna. The difference between the second oscillator frequency and the first i-f frequency is the second mixer output. This output is a 455 kc signal.

e. Second IF

A "Permakay" i-f filter containing a transistor amplifier stage is used in the second i-f. The filter sections are permanently sealed in polyesterstyrene and the filter is unconditionally guaranteed for the life of the receiver, provided the seal

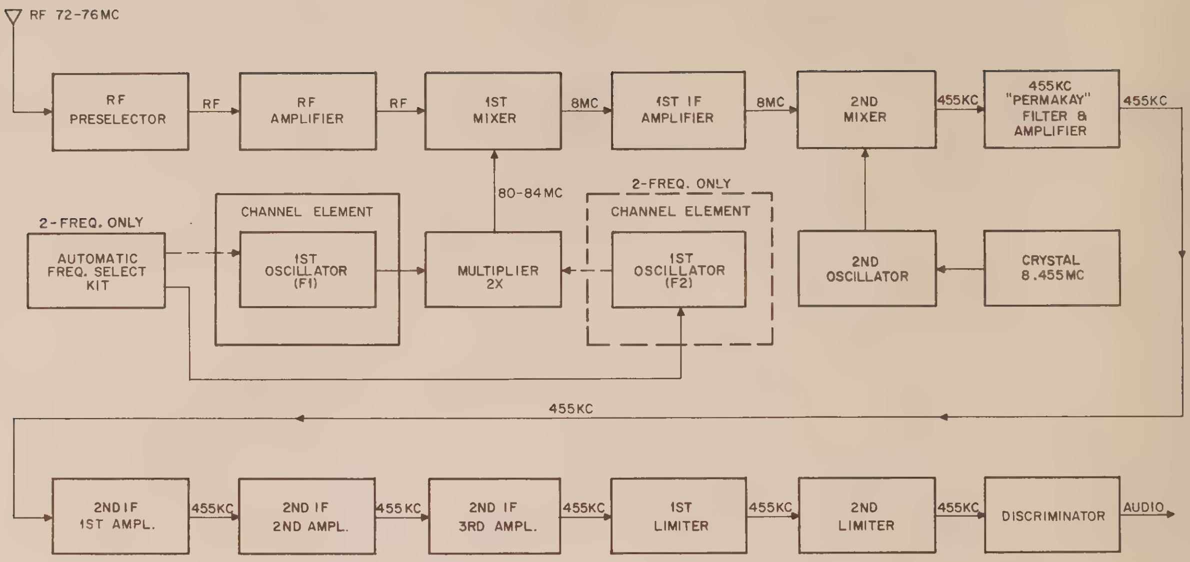

RF 72-76MC
RF PRESELECTOR
RF
RF AMPLIFIER
RF
1ST MIXER
8MC
1ST IF AMPLIFIER
8MC
2ND MIXER
455KC
455KC "PERMAKAY" FILTER & AMPLIFIER
455KC
80-84 MC
2-FREQ. ONLY
CHANNEL ELEMENT
1ST OSCILLATOR (F1)
MULTIPLIER 2X
2-FREQ. ONLY
CHANNEL ELEMENT
1ST OSCILLATOR (F2)
AUTOMATIC FREQ. SELECT KIT
2ND OSCILLATOR
CRYSTAL 8.455MC
455KC
2ND IF 1ST AMPL.
455KC
2ND IF 2ND AMPL.
455KC
2ND IF 3RD AMPL.
455KC
1ST LIMITER
455KC
2ND LIMITER
455KC
DISCRIMINATOR
AUDIO

DIAGRAM NO. 69C81033A39-A

Figure 2
Receiver Block Control

is not broken and the housing is not tampered with. The amplifier circuitry is mounted to an eyelet board within the filter and is acessible for servicing. This filter is the major factor in determining the bandwidth and selectivity of the receiver. It greatly attenuates the signal outside the pre-determined bandpass. Three i-f amplifier stages follow the 455 kc filter to saturate the limiter.

f. Limiter Stages

The two limiter stages are 455 kc amplifiers arranged so that an increase in input signal produces no change in the amplitude of the output signal. Operation of the limiter depends upon the application of a large amplitude signal. The limiters are in full saturation at all times, that is, with weak or strong signals or noise only.

When a negative alternation of the signal is applied to the N-P-N first limiter, the base is driven negative with respect to the emitter. This places a reverse bias at the emitter-base junction, causing the collector current to drop to zero. During the positive half of the input signal, the base becomes more positive, increasing the emitter-to-collector current to its maximum value. Thus with a signal, the collector current is driven to cut-off and maximum. Operation of the second limiter is essentially the same, except that the signal undergoes a phase reversal in the first limiter and the P-N-P transistor performs the same functions when its input signal is of opposite polarity. The output of the limiter is a signal of constant amplitude.

g. Discriminator

The discriminator used is a phase discriminator, that is, the operation is dependent upon a 90° phase shift which occurs at resonance between the primary and secondary voltages of the tuned transformer.

The discriminator recovers the audio from the 455 kc i-f signal. A typical discriminator response curve is shown in Figure 3. The i-f signal varies in frequency at the audio rate. This is shown below the curve. The corresponding audio output is drawn to the right of the curve.

h. Automatic Frequency Select Kit

The automatic frequency select kit is used in two-frequency systems which have the operator release feature. This kit basically consists of a printed circuit board with an astable multivibrator and two driver stages. With both control transmitters (A & B) turned off, the astable has a period of 500 milliseconds. Each side of the astable triggers a driver transistor which grounds each channel element alternately. When transmitter "A" is turned on, the operator release board recognizes the address and turns on the transmitter "A" driver Q21 which puts 3.9 volts on TB104-1 of the receiver-decoder. This 3.9 volt command locks-up that stage of the astable multivibrator which selects channel element "A". The other trigger point remains at 18 volts which inhibits channel element "B" if transmitter "A" is turned off without commanding the operator release. The two-frequency select board will accept signals on frequency "A" only for forty-five seconds. After that time, the two-frequency select board and the operator release board will accept either transmitter "A" or "B" on a first-come first-serve basis. However, if transmitter "A" is turned off after the operator release command is given and transmitter "B" is turned on, the transmitter "A" driver Q21 returns to 18 v dc and the transmitter "B" driver Q22 puts 3.9 volts on TB104-2 of the receiver-decoder. This 3.9 volt command locks-up the other stage of the astable multivibrator which in turn selects frequency "B" in the receiver. Since the other side of the astable is at 18 volts, channel element "A" is now inhibited.

3. DECODER

Refer to Receiver-Decoder Unit Functional Block Diagram. The receiver discriminator output, which is composed of continuous two-tone signals (one in the 490-1270 cps band and one in the 1530-2830 cps band) is coupled to an audio amplifier where the level is increased. This amplified audio signal is coupled to high and low pass filters where the two audio frequencies are separated and routed to separate audio limiters. These limiters compensate for level variations in the received signal and provide a constant input level to tone filters which are part of the tone decoder circuits.

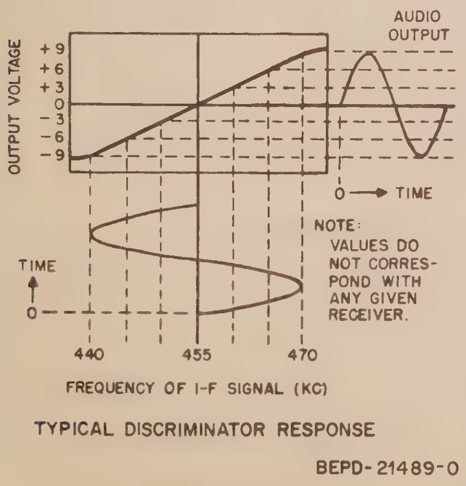


Figure 3
Typical Discriminator Response

There are eleven tone decoders in the high tone group and seven decoders in the low tone group. The threshold level of these decoders and the output level of the limiters are such that only one tone in each group can be detected at one time. Thus, if an interfering signal of the proper amplitude and frequency and a valid command signal are presented simultaneously to a limiter, neither signal is decoded. The tone decoders convert the audio signals detected by the individual tone filters to discrete dc levels. From this point on in the system the entire decoding scheme is based on dc rather than audio levels.

a. Group Check Procedures

In addition to the foregoing, a procedure known as group check is used to detect false tone signals. These circuits check the output of all tone decoders in a group. If more than one tone output or the absence of tones is detected at any one time, an inhibit voltage is developed and sent to the address and sequence verifiers to prevent any function commands from taking place. The inhibit voltage is also operated by the 2830 cps tone decoder since it is always used as a stop command in the system. The inhibit voltages are carried on the "code check" wire.

b. Coding Scheme

As previously described, the coding scheme employed in this system requires that a valid address be recognized before any functions take place. The address information is contained in the first three 20-millisecond time slots of a command frame (refer to the DESCRIPTION section of this manual for a detailed description of the command frame coding scheme) and is composed of three of the six high frequency tones (M through T). Each of these three tones must be accompanied by either tones F or G in the low frequency tone group. The outputs of high frequency tone decoders M through T are routed to the CLN6114A Address Plug which determines which of the six tones is to be fed into the three time slot inputs of the CLN6083B Address Verifier Circuit Board. This address plug is uniquely wired for each system. The CLN6153A Two-Address Plug Kit is also uniquely wired and determines the tones sent to the CLN6167A Operator Release Kit.

c. Coding Logic

When the proper high and low frequency tone outputs for the first time slot are sensed at the first AND gate, a monostable multivibrator is triggered. This monostable multivibrator provides an enable voltage, which has a duration of 30 milliseconds, to the second AND gate. If the second set of address tones are present at the other two inputs of the second AND gate during this

30 millisecond period, a starter sync pulse is sent to the start-stop bistable on the CLN6082B Sequence Verifier Circuit Board. The bistable then starts the scanner in the sequence verifier. The output of the first AND circuit in the sequence verifier then provides an enable voltage to the third AND circuit on the address verifier for 20 milliseconds during which time the third set of high and low frequency tones must be present at the third address AND gate. If this sequence takes place properly, a 360 millisecond hold circuit on the address verifier is actuated. This hold circuit provides an enable voltage to the address relay driver, sequence verifier output gates, and auxiliary function decoders associated with the first three (address) time slots. This enable voltage remains on as long as a valid address is detected once every 320 milliseconds (one command frame) and no inhibit voltage is generated by the group check or tone U (2830 cps) decoder.

As described previously, the sequence verifier is actuated by the second AND gate of the address verifier. The astable and bistable multivibrators and associated AND gates form a time slot sequence generating circuit similar to the scanner circuit in the control transmitter. The outputs of AND circuits 2 through 5 provide enable voltage of the motor function decoders associated with time slots 4 through 7, respectively. The output of AND gate 6 provides the enable voltage to the auxiliary function decoders associated with time slot 8. The output of AND gate 7 provides a stop pulse to the start-stop bistable, stopping the astable until it is restarted by the address verifier sync pulse on the next command frame cycle.

d. Motor Function Decoder

Each of the CLN6094B Motor Function Decoder Boards contains 10 decoder circuits, providing each board with the capability of controlling 5 speeds in either of two directions. The bridge, trolley, hoist and auxiliary hoist motors each have separate motor function decoders and associated relay driver assemblies. A motor function decoder is composed of a three-input AND gate and a 180 millisecond hold circuit. All ten AND gates on a board have two common inputs. One of these common inputs is connected to the low frequency tone associated with that particular motor and the other to the sequence verifier gate associated with the particular time slot. The third input of each AND gate is connected to the ten high frequency tone decoder outputs (H through T), with each high tone representing a particular speed and direction. If the proper high frequency, low frequency tone, and sequence verifier (time slot) outputs are received simultaneously, the associated 180 millisecond hold circuit is actuated. Thus, if the signal is repeated every 160 milliseconds, a steady dc level will be present at the output of the hold circuit.

e. Relay Driver and Diode Matrix

The output of each motor function decoder board is connected to a CLN6093A Relay Driver Circuit Board or a CLN1040A Diode Matrix Circuit Board. These boards are similar in that both the diode matrix and the relay driver include OR gates which control relay driver amplifiers. The logic circuitry dictated by the crane motor to be controlled determines the diode arrangement. The CLN6093A Relay Driver Circuit Board has six relay drivers and a predetermined diode arrangement and is used for the bridge and trolley motors. The CLN1040A Diode Matrix Circuit Board has 12 relay driver circuits with its diode arrangement determined by the particular hoist used on the crane.

The outputs of the various relay drivers operate control relays in the interface relay cabinet which operate the intermediate power relays. These in turn, operate the crane control contactors which provide power to the crane motors.

f. Activity Check Circuits

As an additional safety measure, power for all control relays is routed through the operate relay and the activity check relay. The operate relay is operated by the address relay driver and address verification relay. The activity check relay is normally operated and controlled by the activity check circuit on the CLN6084B Auxiliary Function Decoder Board. This activity check circuit compares operation of the relay with the presence of the first address high frequency tone. If the operate relay is operated and no high frequency tone has been detected, a system malfunction has occurred and the activity relay will drop out, removing power from the function control relays. An additional contact is provided on the activity check relay to prevent the first address high frequency tone from re-energizing the relay before the malfunction is corrected.

g. Auxiliary Function Decoder

In addition to the activity check circuits, the auxiliary function decoder board contains eight relay driver amplifiers and associated decoders. The first two decoders are wired into the eighth time slot and use unique tone codes for magnet and grapple control. The third decoder requires the first address high frequency tone, the address enable voltage, and the low frequency tone F for operation. Normally, the third decoder is used for the alarm function. The fourth and fifth decoders form a bistable or electronically latched circuit which may be wired into the third or eighth time slot. Normally these decoders are used to control the crane lights or power. When the system power supply is initially turned on, the bistable decoder-off relay is activated.

The sixth decoder is similar to the third, except that it requires the second address high frequency tone instead of the first for operation. The seventh and eigth decoders operate as a pair and are wired in the eigth time slot when used to operate the hook rotate function. When the seventh and eighth decoders are used in a five-motor system, they alternately supply power to the main and auxiliary trolley depending on the selection made at the control transmitter. The relay driver amplifier outputs are then connected to both the main and auxiliary trolley control relays, with only one capable of operating at any one time.

h. Automatic Safety Override Circuit

This circuit disables the address relay in the event of a hung-up or malfunctioning motor direction-control relay. The CLN6151B Automatic Safety Override Circuit Board, incorporates four motor detection circuits which, via an OR gate, sense the presence of any one of the ten speed command tones. The OR gates output, together with the proper low frequency tone, and sequence verifier (time slot) outputs are fed through an AND gate which operates a HOLD circuit. This circuit can also be operated by the forward and reverse intermediate power relays, or hoist relays A and B. Thus, if a valid speed command is detected or both the forward and reverse relays are de-energized, the hold circuit will actuate. If this circuit is not actuated (no speed command and either direction relay is energized), an inhibit voltage is applied to the ASO gate board. This causes the address control and power relays to drop out, removing power from the main contactors of all motors and the control relays for all motor speeds except forward and reverse. Thus, no functions can be activated.

A feature of this circuit is the ability to operate motors when a relay is malfunctioning by using a special operating procedure. If the motor containing the malfunctioning relay is commanded and held, all other motors will operate normally since the conditions of the automatic safety override circuit are satisfied. (CAUTION: motion of the malfunctioning motor may result depending upon the type of malfunction that occurred.)

j. Operator Release Circuit

The operator release option allows a crane to be operated by either of two control transmitters subject to the following conditions:

Initially, the receiver-decoder accepts the address of either control transmitter A or B on a first-come, first-served basis. When one of the units starts transmitting, the operator release circuit locks to that control transmitter's address and the receiver-decoder will no longer accept commands from the other control transmitter.

For example, if the receiver-decoder accepts only address A, it does not go back to its initial state until one of two things occur: (1) The operator of transmitter A pushes the "RELEASE" button on his transmitter and then discontinues transmitting; (2) The operator of transmitter A discontinues transmitting for a period of time equal to the built-in "time-out" interval (approximately 40 seconds).

If either of the foregoing events occur, the receiver-decoder will again be available on a first-come, first-served basis to transmitters A or B.

An additional circuit feature prevents the main line contactor from dropping out for a period of approximately 6 seconds after the releasing transmitter is turned off. This delay gives the second operator time to take over the crane without the annoying drop out of power. The result is a smooth and uninterrupted transfer of crane control from one operator to the other.

The two addresses which can be recognized by the operator release circuit are interrelated. The first high frequency tone of address A is the second high frequency tone of address B and vice versa. The third high frequency tone of both addresses is unique. For example, a possible pair of addresses might be TSN and STM.

The operator release circuit is essentially divided into two circuits: the address verification circuit, and the address selection circuit.

(1) Address Verification

The operation of the address verification circuit is very similar to that of the address verifier in systems without operator release functions. The address verification circuit merely recognizes one of two addresses and allows the crane to be operated. When one address has been recognized, the address selection circuit senses the first address and feeds back inhibiting signals which keep the address verification circuit from recognizing the other address.

Refer to the Operator Release Functional Diagram. For example, let the address A be transmitted. Then, if the proper high and low frequency tones for the first time slot are present, AND gate A1 will be activated. The output of AND gate A1 activates the 33 millisecond HOLD circuit A which holds over the recognition of the first address tone into the second time slot. In the second time slot is also the address A second high frequency tone, which is fed directly to AND gate A2. When AND gate A2 is activated, the output goes through OR gate 1 to the START-STOP bistable multivibrator on the CLN6082B Sequence Verifier Circuit Board. The bistable multivibrator will then start the scanner in the sequence verifier. The address A second high frequency tone is also fed into AND gate B1 with the low frequency tones. The output of AND gate B1 activates another 33 millisecond HOLD circuit B which causes recognition of the second address tone to be held over into the third time slot. HOLD circuit B and the low frequency tones feed AND gate A3, the third time slot (gate from the sequence verifier), and the address A third high frequency tone. The output of AND gate A3 activates, through OR gate 2, a 360 millisecond HOLD circuit. This HOLD circuit provides a pulse to set the "ACCEPT-SELECT" bistable multivibrator to the "SELECT" state and an enabling voltage to the address relay driver, sequence verifier output gate (enable) and auxiliary function decoders associated with the first three (address) time slots. This enabling voltage remains on as long as a valid address is detected once every 320 milliseconds (one command frame) and no inhibit voltage is generated by the group check, automatic safety override, or tone U (2830 cps) decoder.

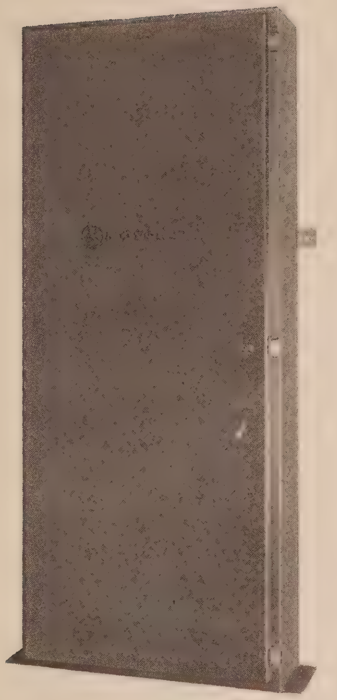
(2) Address Selection

When an output occurs at point "A", the "A or B" bistable multivibrator is set through AND gate A3 to the "A" state. In this state, inhibiting voltages from the "A or B" bistable and the "ACCEPT-SELECT" bistable are fed back through OR gate B to AND gate B2 and B3. Since address B requires activiation of gates B2 and B3 in order to operate the system, it cannot be recognized as a valid address. The inhibiting voltage from OR gate B opens the transmitter B relay leaving only the transmitter A relay closed. If lights mounted on the crane are connected to these relays, there is a visual indication that only transmitter A has control of the system.

To reset the "ACCEPT-SELECT" bistable multivibrator to the "ACCEPT" state so that neither address is inhibited, a pulse is applied to that bistable multivibrator from the "RELEASE" bistable multivibrator or from the timer. The "RELEASE" bistable multivibrator is set by a signal from the operator release decoder on the CLN6084B Auxiliary Function Decoder Board, and reset with an "ACCEPT" pulse when the transmitter stops sending.

The purpose of the timer is to automatically generate an "ACCEPT" pulse if the operator fails to use the system within a 45-second period after his last transmission.

INTERFACE RELAY UNIT



MODEL TABLE

MODELS	DESCRIPTION
	DC MODELS
C1146A	THREE MOTORS, THREE SPEEDS
C1147A	THREE MOTORS, FIVE SPEEDS
C1148A	FOURTH MOTOR, AUX HOIST
C1149A	FOURTH AND FIFTH MOTOR, THREE SPEEDS
C1180A	FOURTH AND FIFTH MOTOR, FIVE SPEEDS
	AC MODELS
C1156A	THREE MOTORS, THREE SPEEDS
C1157A	THREE MOTORS, FIVE SPEEDS
C1158A	FOURTH MOTOR, AUX HOIST
C1159A	FOURTH AND FIFTH MOTOR, THREE SPEEDS
C1185A	FOURTH AND FIFTH MOTOR, FIVE SPEEDS

1. INTRODUCTION

The interface relay units contain all the control and intermediate power relays used in the Motorola Portable Remote Controls for Cranes. Transistor drivers in the receiver-decoder unit actuate the control relays which, in turn, actuate the associated intermediate power relays. The intermediate power relays provide the necessary switching for the crane motor contactors. These relays are heavy duty types with replaceable contacts.

Control relays and their associated intermediate power relays are mounted on the same panel. Seven to thirteen relay panels may be used in a system, depending on the complexity of the crane. When more than eight panels are used, two cabinets are required. The cabinets are dust and moisture resistant and have key-locked doors for security.

Units are available for three-, four- and five-motor cranes (bridge, trolley, hoist, auxiliary trolley, and auxiliary hoist) with three or five speeds. AC and DC models are available so that the intermediate power relays can be powered directly from a 250 v dc or 117 v ac crane source. The equipment included in all basic system models is listed in the Model Chart. These models may also come equipped with one or more auxiliary function relay kits which are listed in the following table. These kits are factory installed.

MOTOROLA

MODEL CHART

FOR

PORTABLE REMOTE CONTROL INTERFACE RELAY UNITS

AND CABINET KIT

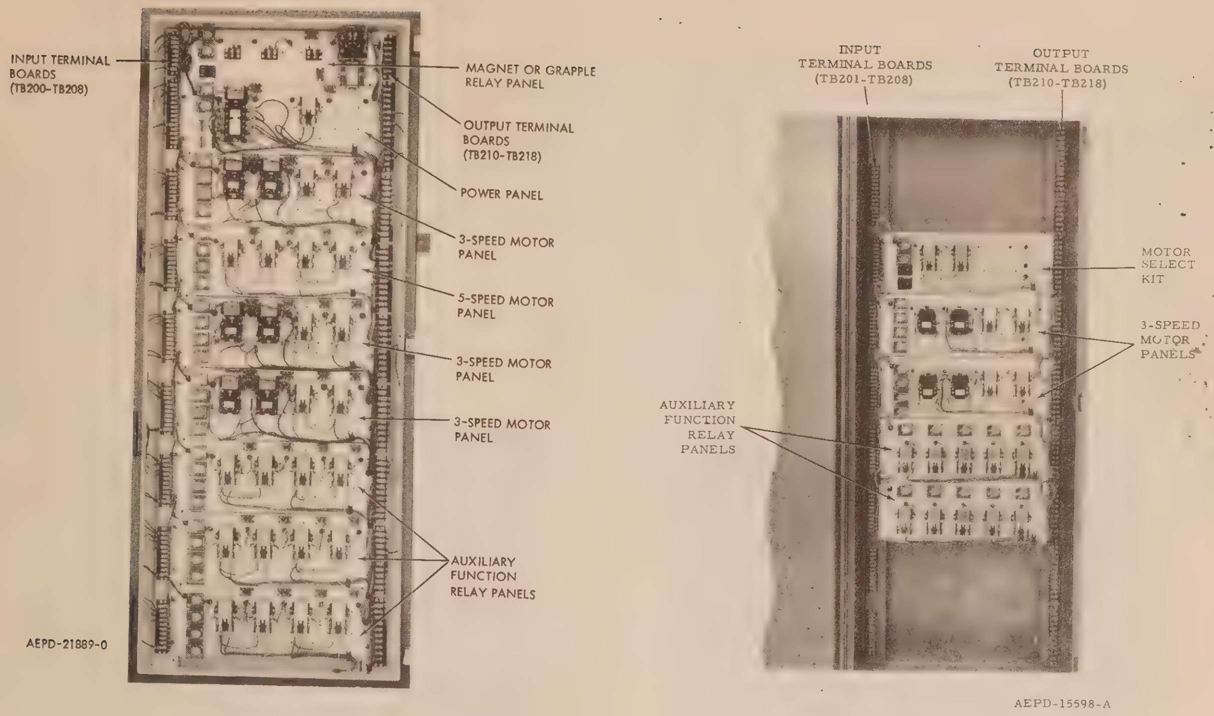
CODE:

- X = ONE ITEM SUPPLIED
- 2 = NUMBER OF ITEMS SUPPLIED
- O = ONE OR TWO ITEMS SUPPLIED, DEPENDING UPON APPLICATION
- / = TWO OR THREE ITEMS SUPPLIED, DEPENDING UPON APPLICATION
- A = QUANTITY USED DEPENDS UPON APPLICATION

* OPTIONAL PANEL

ITEMS	MODELS	C1146A	C1147A	C1148A	C1149A	C1180A	C1156A	C1157A	C1158A	C1159A	C1185A	C1131A
		DC MODELS					AC MODELS					
	DESCRIPTION	THREE MOTORS, THREE SPEEDS	THREE MOTORS, FIVE SPEEDS	FOURTH MOTOR, AUX. HOIST	FOURTH AND FIFTH MOTOR, THREE SPEEDS	FOURTH AND FIFTH MOTOR, FIVE SPEEDS	THREE MOTORS, THREE SPEEDS	THREE MOTORS, FIVE SPEEDS	FOURTH MOTOR, AUX. HOIST	FOURTH AND FIFTH MOTORS, THREE SPEEDS	FOURTH AND FIFTH MOTORS, FIVE SPEEDS	CABINET
CLN6177A	DC POWER PANEL	X	X									
CLN6180A	AC POWER PANEL						X	X				
CLN6106A	DC MOTOR PANEL, THREE SPEEDS	3	3	X	2	2						
CLN6121B	MOTOR SELECT KIT				X	X				X	X	
CLN6107A	DC MOTOR PANEL, (TWO MOTORS) FIVE SPEEDS		X									
CLN6100A	AC MOTOR PANEL, THREE SPEEDS						3	3	X	2	2	
CLN6101A	AC MOTOR PANEL, (TWO MOTORS) FIVE SPEEDS							X				
CLN6168A	AUXILIARY FUNCTION RELAY PANEL	/	/	O	O	O	/	/	O	O	O	
CLN6103A	AUXILIARY FUNCTION RELAY KIT, NORMALLY OPEN, AC						A	A	A	A	A	
CLN6104A	AUXILIARY FUNCTION RELAY KIT, NORMALLY CLOSED, AC						A	A	A	A	A	
CLN6109A	AUXILIARY FUNCTION RELAY KIT, NORMALLY OPEN, DC	A	A	A	A	A						
CLN6110A	AUXILIARY FUNCTION RELAY KIT, NORMALLY CLOSED, DC	A	A	A	A	A						
CHN6013A	CABINET KIT											X
CLN6120A	CABINET ACCESSORY KIT											X
CKN6014A	JUMPER CABLE KIT											X
*CLN6179A	DC MOTOR PANEL, THREE SPEEDS (NEMA-8)											
*CLN6182A	AC MOTOR PANEL, THREE SPEEDS (NEMA-8)											

EPD-17497-A


INPUT TERMINAL BOARDS (TB200-TB208)
MAGNET OR GRAPPLE RELAY PANEL
OUTPUT TERMINAL BOARDS (TB210-TB218)
POWER PANEL
3-SPEED MOTOR PANEL
5-SPEED MOTOR PANEL
3-SPEED MOTOR PANEL
3-SPEED MOTOR PANEL
AUXILIARY FUNCTION RELAY PANELS
AEPD-21889-0
INPUT TERMINAL BOARDS (TB201-TB208)
OUTPUT TERMINAL BOARDS (TB210-TB218)
MOTOR SELECT KIT
3-SPEED MOTOR PANELS
AUXILIARY FUNCTION RELAY PANELS
AEPD-15598-A

Cabinet 1

Cabinet 2

Typical 5-Motor, 5-Speed Interface Relay Unit
With Auxiliary Function Relay Panels

AUXILIARY FUNCTION RELAY KITS

KIT MODEL	DESCRIPTION
CLN1026AA,	Lights On-Off, DC
CLN1027AA,AB,AC	Brake, DC
CLN1028AA,AB,	Operator Release (DC)
CLN1029AB	Hook Rotate, DC
CLN1030AA,	Hold, DC
CLN1033AE	Alarm, DC
CLN1035AD	Magnet, DC
CLN1036AD	Grapple, DC
CLN1037AE	Alarm/Reset, DC
CLN1038AE	Reset, DC
CLN1046AA,	Lights On-Off, AC
CLN1047AA, AB, AC	Brake, AC
CLN1048AA, AB,	Operator Release (AC)
CLN1049AB	Hook Rotate, AC
CLN1050AA,	Hold, AC
CLN1053AE	Alarm, AC
CLN1055AD	Magnet, AC
CLN1056AD	Grapple, AC
CLN1057AE	Alarm/Reset, AC
CLN1058AE	Reset, AC

NOTE

For panel and relay position, refer to page 11-2.

2. INTERFACE RELAY PANELS.

a. General

All interface relay panels and function relays are mounted in specific positions in their respective cabinets. A typical five-motor, five-speed interface unit with optional auxiliary function relay kits is shown in the photographs above. A more detailed illustration of the panel placement and relay-to-function relationship is shown in Intercabling and Equipment Location Diagram for the Interface Relay Unit. By using the information on this diagram, the location of all control and intermediate power relays can be determined for every crane function. Once this relationship is determined, it should be of help to maintenance personnel in the future.

NOTE

The last letter of a model number determines the position of the relay kit on a panel.

b. Power Panel

The power panel controls the power (18 v dc) applied to the control relays and the power switched to all "main" contactors on the various motor control panels (see Power Panel Schematic Diagram for the Interface Relay Unit). The panel also has facilities for mounting the grapple or magnet auxiliary function relay kits.

The activity relay and its associated circuitry compare operation of the operate relay with the presence of the first address high frequency tone. If the operate relay is operated but no high frequency tone is detected, a system malfunction has occurred and the activity relay will drop out, removing power from the function control relays. When a proper address is detected at the receiver-decoder, relays K1, K2 and K5 are energized and 18 v dc is switched through the contacts of K1 and K5 to all control relays, thus enabling all functions. In the event K2 or K5 lock up without the recognition of activity, K1 will drop out and disconnect 18 v dc from the control relays, thus disabling all functions.

Address relay K2 is connected to the address verifier circuit in the receiver-decoder and is operated when a valid address is received and decoded. The address verifier, in turn, operates operate relay K5.

Relay K5 is operated by K2; it applies switched 18 v dc (through the activity relay) to the control relays. Contacts 5 through 14 provide a series or secondary closure to the main motor contactors in the crane controller. In this way, two closures are required to operate main motor contactors. Contacts 15 and 16 provide an energized or de-energized condition indication to the activity circuit in the receiver-decoder. Contacts 17 and 18 can be used to control an indicator which displays the state of the operate relay.

The auxiliary function relay kits which can be added to the panel for the magnet and grapple functions are also shown on the schematic. The control relays of these kits plug into sockets K3 and K4. The power relays mount to the panel and are wired to TB3 and the output terminal board of the cabinet. The grapple power relays are momentary types and the magnet relays are mechanical latching types to provide the proper closures for these functions.

c. Three-Speed Motor Panel

This panel mounts the relays necessary to drive a typical three-speed motor on either the bridge, trolley or hoist (see Three-Speed Motor Schematic Diagram). Relays K2 and K4 provide the contact closures for the undervoltage circuitry on the motor control panel as well as the direction and main motor contactors. The normally closed contacts operate the undervoltage circuitry, while contacts 5 and 6 of K2, and 3 and 4 of K4, operate the motor or main contactor on the particular motor being controlled. In addition, relays K2 and K4 have normally closed contacts which provide the information on the relay state to the automatic safety override circuitry.

d. Five-Speed Motor Panels

These panels provide additional relays required to operate the fourth and fifth speed contactors on a standard or bridge or trolley motor control panel (see Five-Speed Motor Panel Schematic Diagram).

e. Auxiliary Function Relay Panel And Relay Kits

Refer to Auxiliary Function Relay Schematic Diagram.

The auxiliary function relay panel is used for two purposes: (1) to house the various auxiliary functions unique to each crane and, (2) provide additional mounting space for the relays required to drive hoist and auxiliary hoist motor controllers. Two to five of these panels may be used in a system.

The hoist motors in some systems may require up to 12 relay kits (control and intermediate power relays), depending upon the complexity of the hoist. Normally, four of these kits appear on a three-speed motor panel. The additional relay kits required are then mounted on the auxiliary function relay panel. The specific location of these relays are given on the intercabling diagram for the cabinet.

Other auxiliary function relay kits listed in this section, require one or two of the auxiliary relay kits shown on the schematic. These kits are normally contained on panels 7 and 8 in the locations indicated on the cabinet intercabling diagram.

3. INTERFACE RELAY CABINETS

One or two Model C1131A Cabinet Kits are required for the interface relay panels depending on the capacity of the system. These weatherproof cabinets are 63" high, 26" wide, 9" deep and are constructed of heavy gauge aluminum. The cabinet doors easily slip on and off the side hinges.

4. MAINTENANCE

Refer to the MAINTENANCE section of this manual.

POWER SUPPLIES

C1160B
DC Power Supply

C1163A RC Filter

MODEL TABLE

MODEL	DESCRIPTION	APPLICATION
C1160B	DC POWER SUPPLY	250 V DC POWERED CRANES
C1163A	RC FILTER	
C1161A	AC POWER SUPPLY	120 V AC POWERED CRANES
C1162A	AC POWER SUPPLY	240/440 V AC POWERED CRANES

1. GENERAL DESCRIPTION

The power supplies used in the Motorola portable remote control systems for cranes provide output voltages which are essentially free from variations even though they operate in circuits serving crane motors and brakes. This means that the transistorized receiver-decoder circuitry is unaffected by crane operation, assuring reliable performance.

The power supplies described in this section provide regulated and filtered 3.9, 14 and 18 v dc to the receiver-decoder unit and 120 v ac or 250 v dc (filtered), depending upon the type of crane power (ac or dc), to the intermediate power relays in the interface relay units.

2. MODELS C1160B POWER SUPPLY AND C1163A RC FILTER

a. General

These units are used on cranes powered by 250 v dc. The power supply unit contains inverter and regulator circuits (CLN6159A) and the filter unit contains an RC filter. Both units have key-locked hinged front panels. DC input power is converted to ac and then back to low voltage dc to power the receiver-decoder circuits. Surges and transients are eliminated from the dc output before being applied to the control relays.

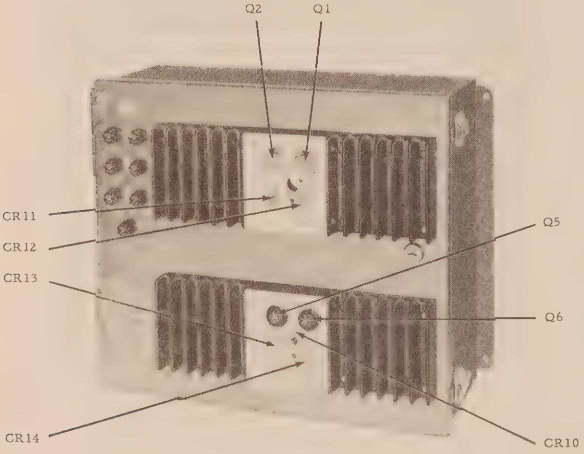
b. Circuit Operation

Refer to Power Supply (250 v dc output) and RC Filter Kit Schematic Diagrams.

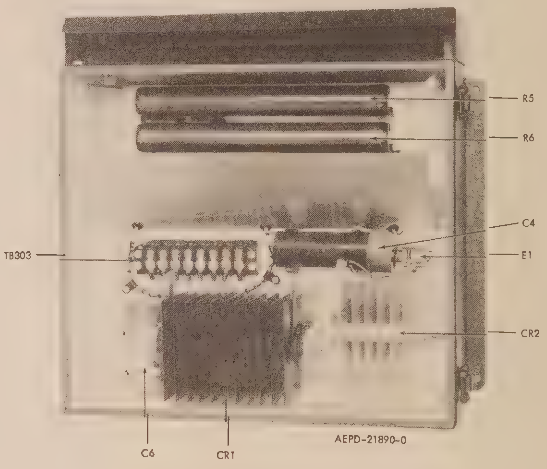
(1) Filtering

The 250 v dc crane power source is applied to terminals 9 and 10 of TB301 (Power Supply Schematic Diagram). The source is fused by F2 and F4, then filtered by L2, C4 and L3, C5. All this is terminated at terminals 7 and 8 of TB301. Inter-cabinet cabling routes the fused 250 v dc to the filter cabinet, terminals 7 and 8 of TB303 (RC Filter Kit Schematic Diagram).

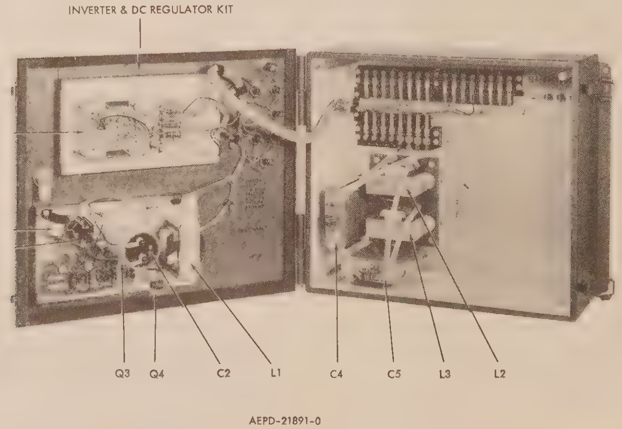
The filter kit contains two RC filter networks. The RC network associated with diode CR1


Q2
Q1
CR11
CR12
Q5
CR13
Q6
CR14
CR10

C1160B DC Power Supply (Door Closed)


R5
R6
C4
TB303
E1
CR2
C6
CR1
AEPD-21890-0

C1163A RC Filter (Door Removed)


INVERTER & DC REGULATOR KIT
Q3
Q4
C2
L1
C4
C5
L3
L2
AEPD-21891-0

C1160B DC Power Supply (Door Open)

Figure 1.
Power Supply and Filter Parts Locations

removes large spikes and filters the 250-volt power source before it is applied to the intermediate power relays in the interface units. CR1 is a surge suppressor that acts as a clipping diode in that it does not permit the voltage across it to rise above 330 volts. When a transient or other ac component on the line exceeds 330 volts peak-to-peak, CR1 will conduct to limit the peak value of the component.

Filtered 250 v d-c for the intermediate power relays is returned to the inverter and d-c regulator cabinet at terminals 5 and 6 of TB301 via intercabinet cabling. Note, that power can be applied to the intermediate power relays directly, or through an external switch. An optional external switch of this type would permit disabling the control relays when manual control is desired.

The RC filter network associated with diode CR2 removes all transients from the d-c source and, together with Zener diodes in the inverter and d-c regulator kit, provides 80 v d-c to the power supply inverter. Four Zener diodes (CR11, 12, 13 and 14) connected between terminals 1 and 2 of TB302 (Power Supply Schematic Diagram) and resistors R9 and R10 in the filter kit are wired in series across the CR2 filter network by the intercabinet cabling. This combination produces a constant 80 v dc output which is applied to the inverter circuit. CR2 performs the same function in this filter network as CR1 does in the control relay filter except that its "breakdown" voltage is 180 volts. E1 is a spark-gap transient suppressor which protects against transients that appear between line and ground. Its "breakdown" voltage is 750 v dc.

(2) Inverter Circuit

The inverter circuit (Power Supply Schematic Diagram) converts the 80 v dc applied to its input to a 5 kc, 60-volt peak-to-peak square wave output. The circuit action is as follows:

When voltage is applied to the center tapped primary of power transformer T1B, current flows through the lower half of T1B, resistors R4 and R1, and feedback section T1A of the transformer. This current flow forward biases the base-emitter junction of transistor Q1, turning it on. Current now flows through the top half of the primary of T1B and from the collector to the emitter of Q1. A voltage is developed in the secondary of T1B and is applied to the feedback section T1A. The secondary of T1A supplies a positive voltage to the base of Q1, causing it to conduct more. At the same time, a negative voltage is applied to the base of Q2, cutting it off. Current flow in T1A increases steadily until the core becomes saturated.

Once the core is saturated, the current requirements of T1A rise in order to maintain a constant feedback voltage. Since the current is limited by R2, the voltage across T1A begins to decrease. This causes the conduction of Q1 to decrease and reduce the current through T1B. As a result, the current to T1A is further reduced and the magnetic field to T1A collapses instantly, reversing the voltage applied to the base of Q1 and Q2. This action rapidly turns off Q1 and turns on Q2, causing current to flow through the other half of the T1B primary in the opposite direction and reversing the voltage in the secondary of T1B. The feedback voltage is also reversed which causes Q2 to conduct more and Q1 to be cut off. Conduction continues until the core of T1A is saturated again. The cycle is repeated continuously as long as the d-c input is applied, causing current to flow alternately in opposite directions through the two half windings of T1B. The voltage induced in the secondary of T1B by this extremely rapid switching action results in a square wave which is applied to the diode bridge rectifiers.

Resistors R1 and R3 limit the current to the transistor bases for the amount of drive required to supply the desired output. Resistor R4 is a starting resistor and does not affect circuit operation once the switching action is started.

Diodes CR1 and CR2 provide surge protection for the respective transistors. They prevent the base-emitter junction from being reverse biased when the stage is cut off and the rapidly collapsing field in T1B causes a high collector-emitter voltage.

(3) Regulator Circuit

The 5 kc square wave is rectified by diode bridge CR3 and applied to a capacitor input filter to provide a 40-volt (no load) output. The 40-volt output is applied to a regulator that provides well regulated 3.9, 14 and 18 v dc outputs.

The regulator maintains constant outputs with varying loads. A constant output of 20 volts is developed across Zener diode CR8. This voltage is applied to the base of Q4. Transistors Q5 and Q6 form a two-stage series regulator with the emitter of Q5 supplying the required 18 v d-c output. The load from the 18 v d-c output is returned to ground via Zener diode CR10. This establishes the 3.9 v d-c reference.

Zener diode CR9 is connected to the emitter of Q4. It drops the 19-volt reference voltage at that point to approximately 14 volts and applies this voltage to the base of Q6.

3. MODELS C1161A AND C1162A POWER SUPPLIES

a. General

The Model C1161A Power Supply is used on cranes with a 120-volt, 50-60 cycle, single-phase source. The power supply consists of a CLN6129A Power Supply and Regulator Kit (see figure 2). The kit is mounted to a hinged panel that serves as the door for the cabinet. A key lock is provided on the panel.

The Model C1162A Power Supply is used on cranes with either a 240- or 440-volt, 50-60 cycle single-phase source. It is identical to the Model C1161A, except that it also includes a CLN6130A Transformer Kit which steps down the voltage source to 120 volts. This kit is mounted inside the cabinet as indicated in figure 2.

b. Circuit Operation

Refer to Power Supply Schematic Diagram (120 or 220/440 v ac output).

The available ac source is applied directly to the primary of transformer T2, or is applied to isolation transformer T1 and stepped down to 120 v ac and applied to T2. Note also, that the 120 v ac line to the control relays is fused and can be applied directly or through an external switch. An optional external switch of this type would permit disabling the control relays when manual control is desired. The secondary of T2 with its bridge rectifier and choke input filter, supplies the dc voltage required for the regulator circuits and the receiver-decoder unit.

Diode CR1 prevents line transients from damaging the bridge rectifiers. It is a surge suppressor that acts as a clipping diode in that it does not permit the voltage across it to rise above 180 volts. If an ac component on the line exceeds 180 volts, CR1 will conduct to bypass the transient. The 40-volt output is applied to a regulator that provides well regulated 3.9, 14 and 18 v dc outputs.

The regulator maintains constant outputs with varying loads. A constant output of 20 volts is developed across zener diode CR7. This voltage is applied to the base of Q2. Transistors Q3 and Q4 form a two-stage series regulator with the emitter of Q3 supplying the required 18 v dc output. The load from the 18 v dc output is returned to ground via zener diode CR9. This establishes the 3.9 v dc reference.

Zener diode CR8 is connected to the emitter of Q2. It drops the 19-volt reference voltage at that point to approximately 14 volts and applies this voltage to the base of Q4.

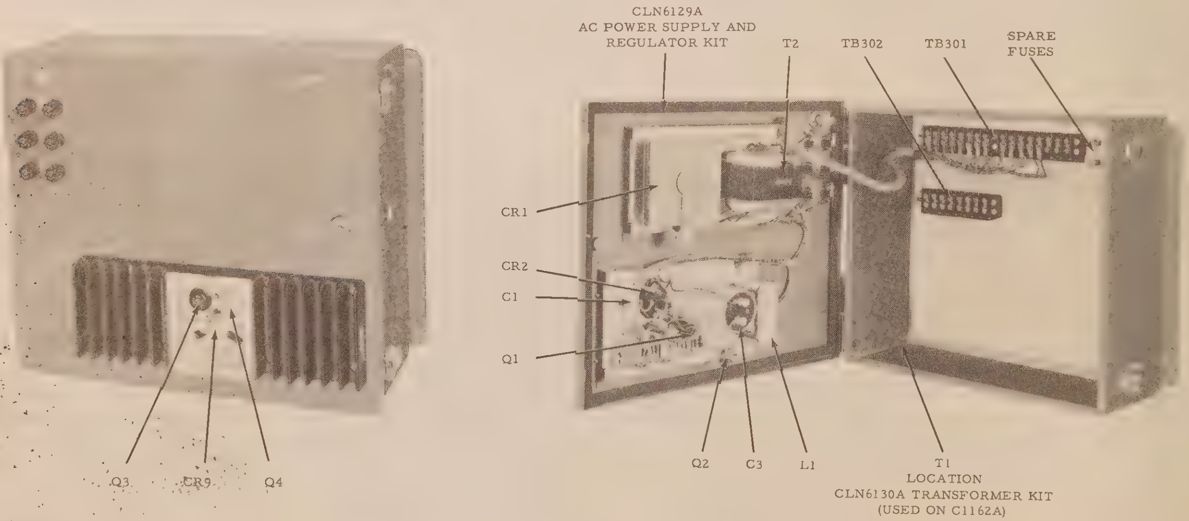


Figure 2.
C1161A and C1162A AC Power Supply Parts Location

4. POWER SUPPLY CABINETS

Two cabinets are used for the power supplies described in this section. .A Model CHN6014A Cabinet Kit is used to house the inverter and regulator kit of the C1160B Power Supply. A Model CHN6010A Cabinet Kit is used to house the C1161A and C1162A Power Supplies. The cabinet is 14" high, 17-1/2" wide, and 8" deep (with front panel in place). The second cabinet kit, a Model CHN6011A, houses the RC filter of the C1160B Power Supply. The cabinet is 16" high, 17-1/2" wide, and 7" deep (with front panel in place). Vents at the top and bottom of the cabinet allow sufficient circulation for the high wattage components in the filter kit. The cabinet door, which is part of the power supply kit, easily slips on and off the side hinges. Catches are provided to help seal the door to the cabinet. Spare fuses for the power supply are also mounted inside the cabinet.

5. SERVICING PRECAUTIONS

When replacing components, remove the associated transistors from their sockets to prevent damage by heat from the soldering iron. If a transistor is wired in the circuit, use pliers to dissipate heat from the leads.

When replacing transistors that require an insulator, both sides must be coated with silicone grease (Motorola Part No. 11T834678) to insure proper heat dissipation. Always make sure that the insulator is in place and that the mounting screws are securely and evenly tightened. If the insulator is not in place, the transistor will be shorted to the chassis. If the mounting screws are not tight, the transistor will be damaged by insufficient heat dissipation.

MAINTENANCE

1. GENERAL

This section outlines the specific duties and responsibilities of maintenance personnel. Experience has shown that there is a particular way of maintaining FM radio equipment used in communication or control systems, that is far superior to any other in achieving maximum operating efficiency and reliability. This procedure is known as "System Maintenance", which simply means that the inspection and maintenance of all units constituting the entire system is conducted in an established and orderly fashion. It is recommended that the procedure be conducted at regular intervals.

All communication or control systems include integrated assemblies. A failure in any of these constitutes a failure of communication or control. There are three major factors which require consideration:

(1) The primary power source.

(2) The basic radio units and their associated accessory items.

(3) The antenna system.

Any successful maintenance program must include the entire system. It would be of little consequence to maintain the basic radio units at top efficiency and to ignore the primary power or the antenna system. A failure in either one results directly in a failure of radio communication or radio control. Therefore, to be successful in maintenance, a program should be developed and closely followed on a basis of all-inclusive system maintenance. Such a program should include a periodic check on all the factors constituting the FM radio communication or control system.

This section recommends specific duties and responsibilities of maintenance personnel. The two phases of maintenance are the preventive maintenance measures and the repair of the equipment when it breaks down. Preventive maintenance is performed on equipment to insure peak operation, and to keep breakdown and needless interruptions in service at a minimum. Preventive measures include visual inspection of electrical and mechanical parts, periodic cleaning and lubrication. These techniques can be performed with a minimum of equipment and effort. Potential failures can often be spotted and corrected before they have a chance to develop. Systematic recording of meter readings and studying of performance characteristics also aid in the prevention of failures. Comparison of data, taken on a particular equipment at regular intervals, reveals slow progressive drifts that may be too small to show up significantly in one test. Any marked variations in the regularly obtained data should be regarded as a sign of an approaching failure and investigated promptly.

2. PREVENTIVE MAINTENANCE PROCEDURE

Step 1 of Paragraph c. Checkout Procedure in the Electronic Equipment Installation and Pre-Operational Checks section of this instruction manual should be performed at least once every 3 months. This will provide an opportunity to spot potential troubles and determine that the crane is being operated "crippled" with one speed inoperative.

3. TYPICAL ADDITIONAL CHECKS AND REPAIR TECHNIQUES

a. Fuses

Fuses, sometimes even when new, may have too much resistance. Check and replace if voltage drop exceeds .1 volt.

b. Fuse Holders

Fuse Holders may loosen or corrode. Accumulation of oil and dirt increases contact resistance. The remedial action is to clean contacts, tighten or replace fuse holder.

c. Relay Contacts

Before attempting any service procedures on any relay contacts, disconnect power from this equipment.

(1) Sensitive Relays

The plastic dust covers on the sensitive relays may be removed by squeezing the cover at the sides and rocking it off its base. The relay itself may be removed by removing the two screws which secure it to the plug-in socket. These screws are accessible from the rear of the relay mounting socket. The contacts on the relays should be burnished when pitted.

(2) Intermediate Power Relays

The intermediate power relays may be removed from the front panel. The contacts should be burnished when pitted. When it appears that the contacts are excessively pitted, they should be replaced. The parts list for the panel on which the relay is mounted, lists the proper replacement contacts. Fully illustrated instructions are packed with each relay contact replacement kit.

d. Primary Power Source

Primary voltages are always suspected in ac circuits as they can often be too high as well as too low. Loose connections on fuses occur even in ac circuits. Check for "hot" fuses and connections.

Primary power sources should be the first check points in preventive maintenance tenance procedures and should be checked periodically.

e. Unit Assemblages

These include the control transmitter, receiver-decoder, power supply, and associated units. Very few adjustments need to be made regularly in the receiver. To catch a maximum number of troubles, the technician must use his eyes, his ears, his sense of touch, and meter measurements, as well as his good judgement and past experience.

Basically, three types of observations are required:

(1) Visual Inspections

Check for loose bolts, screws and clamps, arcing conditions at any point in the equipment, or loose connections. A good visual inspection not only means quickly locating the trouble source. but may prevent more serious trouble from developing later.

(2) Touch Tests

Fuses, fuse holders, resistors, and transformers which are too hot indicate possible trouble sources. Such tests are quick and should be used often.

WARNING

When making touch tests on the equipment, the technician should be extremely careful. Extreme caution should be observed to avoid hazardous electrical shocks.

(3) Meter Measurement

Meter measurements should have been taken at the time of initial installation and recorded. All subsequent measurements should be compared to these initial readings. Should any great variations occur, additional readings within the circuit affected must be taken to see if maintenance is required.

f. Antenna System

Visual checks of antennas, antenna mounting devices, cables, and connectors should be made periodically, as well as meter checks to find any open or shorted lines or high standing wave ratios. Remember that the antenna must efficiently transfer to the receiver the minute voltages picked up from the transmitter to produce a good signal. Failure of the antenna or antenna line is a failure of the communications system.

g. Netting

Netting of the transmitter and receiver in the system is more important than usually realized. The term "netting" means that the receiver and transmitter in the system are aligned on the same frequency. With modern selectivity requirements, it is more than ever necessary to tune the receiver exactly to the frequency it must receive.

h. Rustproofing and Painting

When the finish on the few non-aluminum components has been badly scarred or damaged, rust and corrosion can be prevented by touching up the bare surfaces. Use #0000 sandpaper to clean the surface down to the bare metal; obtain a bright smooth finish, prior to painting.

NOTE

Do not use steel wool or emery cloth. Minute particles frequently enter the equipment and cause harmful internal shorting or grounding of circuits.

i. Required Repairs

(1) Tagging Leads

Tagging of leads is essential to assure that correct re-wiring will be made when a part is replaced. Before unsoldering any leads, tie together the leads that are attached to each part. Use small tags or short pieces of adhesive tape to identify all wires in accordance with their actual connections. Identify every lead that is to be removed.

(2) Parts and Substitutions

When damaged parts must be replaced, identical parts should be used. If the identical replacement component is not available, check the parts list of the respective unit for proper Motorola part number and order the components from the nearest Motorola replacement parts depot. If for any reason substitutions must be made, it is recommended that substitute components be replaced as soon as the proper replacement part is available. The substituted part must have identical electrical properties and must be of equal or higher voltage and current ratings.

(3) Location

Relocation of any part may result in hum or other interference and is not recommended.

(4) Mounting

Mount the new or repaired part in the same mounting as that formerly used by the damaged part. Fasten all mountings securely.

(5) Soldering

Before soldering any connections, carefully scrape all parts that will be touched by the solder until all traces of rust, corrosion, paint or varnish are removed. Dust the scraped parts with a small clean brush. Tin all surfaces to be soldered. Wrap the wire around the lug to be soldered to obtain sufficient mechanical support. Solder the connection, using a minimum amount of solder with sufficient heat to make the solder flow evenly around the tinned surface.

(6) Printed Circuit Repair Techniques

Printed wiring is rapidly assuming the major role of the various wiring methods used in electronic equipment, and the service technician will be coming into more frequent contact with this new method of wiring.

Among the advantages of using printed wiring are uniformity of assembly, elimination of wiring errors, and almost complete elimination of wire and component dressing problems in critical circuits. Not the least of the advantages is ease of servicing, once a few service techniques unique to printed circuit have been mastered.

Basically, a printed circuit is a metal foil plated onto a laminated plastic board which has been die-punched to shape and drilled to provide the necessary mounting and connection holes. The metal foil replaces the conventional wire leads. Since all the boards for a particular radio unit are made from the same pattern, the wiring is uniform and free from error. Usually components are mounted through holes in the board which means they are held securely in place.

In the past, servicemen have been led to believe that printed circuits are extremely fragile and that an exceptionally low wattage soldering iron must be used to prevent the heat from lifting the plating.

This is a misconception. Experience has shown that using a soldering iron with low heat output, in many cases, has actually caused the damage that the serviceman was trying to prevent. It is absolutely necessary to raise the temperature of the connection until the solder flows freely around the board eyelet. This usually takes a considerable length of time with a very low heat iron. During this time heat is conducted away from the connection by the printed wiring, causing them in some instances to break away from the board. If a component is to be removed, its soldered connections must be raised to a temperature that permits free flow of solder. Otherwise, the component's leads may not be freed from the printed wiring and the wiring will be pulled loose from the board as the component is removed. The No. 776 soldering iron (47.5 watts, 850°F heating element) supplied with the Motorola Printed Circuit Repair Kit is recommended for most work on printed circuit boards. This high-heat iron need be applied only a very short time to heat a connnection to the point where solder flows freely. It is obvious that an iron this hot should not be held on a connection longer than necessary. Extended periods of high heat will cause the foil to peel loose from the board.

The tip of the iron has a tapered point to permit its exact application to the desired connection in compact equipment. Always keep the iron tip well tinned and clean.

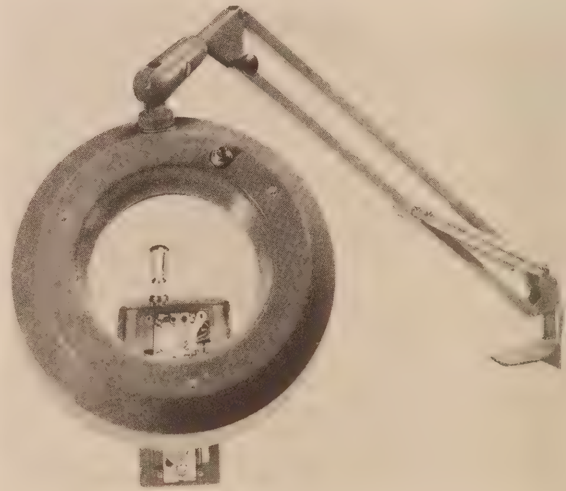
Breaks in the printed wiring can be repaired by bridging the gap with solder. Remove the resin coating covering the printed wiring with solvent before soldering. Large areas of the printed wiring that have peeled loose can be repaired with a piece of hook-up wire. The hook-up wire should follow along the path of the original printed wiring. This avoids any lead dressing problem in critical circuits.

When removing resistors, capacitors and similar components, heat the connection to be loosened until the solder is molten. Then brush away or shake off as much of the molten solder as possible. If the leads are bent over, use a soldering-aid tool or a knife to straighten them. It may be necessary to apply the soldering iron while doing this. While applying the soldering iron, wiggle the component lightly to free it. Then lift it from the board. Be sure the component leads are free before trying to remove it or you might pull loose some of the printed circuit wiring. Clean the circuit wiring around the holes with solvent. Install the new component and solder it in place. Coat the cleaned area of the circuit board with silicon resin. Such a coating seals the board from excessive moisture, prevents corrosion of the copper pattern, helps maintain insulation resistance and improves the appearance of the work. Never let solder flux bridge the gaps between the wiring pattern. This can reduce the resistance between circuits to only a few megohms which will cause leakage and disrupt certain electronic circuits. Use solvents to clean away flux after soldering. Defective components can also be replaced by clipping the leads as close to the component as possible. Solder the replacement component to these leads. Caution should be used when applying heat so that the original leads don't fall out of the board. This method of component replacement should not be used if the equipment is subjected to severe vibration.

Complete removal of the printed circuit boards for access to components is not always necessary. Most components are accessible as mounted.

(7) Tools

Motorola has available several items which can be used to aid in parts replacement and repair of the printed circuit board. These tools are described and illustrated in the following paragraphs.



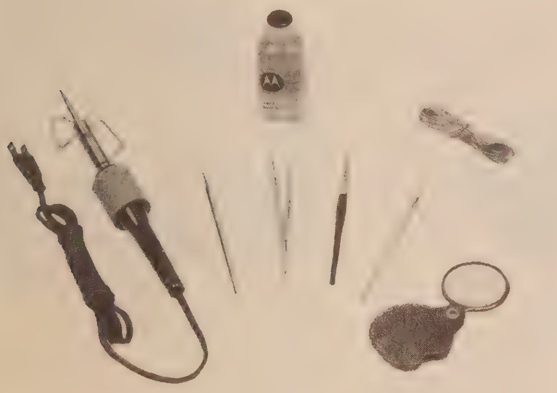
TEKA-12 Magnifying Glass
& Built-In Light Source

(a) Magnifying Glass

Miniaturization requires precision work both in manufacture and in field service. Adequate concentration of light and magnification enables a visual examination of connections and miniature parts. The TEKA-27 or TEKA-12 Magnifying Glass and Built-In Light Source is a most satisfactory device for use in servicing miniature equipment in the shop. This large illuminated magnifying glass makes it easy to see any portion of the small components found on the printed circuit board. Refer to the accompanying illustration.

(b) Printed Circuit Repair Kit

The TEK-4A Printed Circuit Repair Kit supplies most of the basic tools needed for work on printed circuitry and miniature components. Refer to the accompanying illustration.



TEK-4A Printed Circuit Repair Kit

NOTE

The needle point tiplet for the soldering element may be filed to an even finer point to avoid damaging the closely knit printed circuitry.

j. Summary of Recommended Checks

A good preventive maintenance program would require a complete system check at least every three months, preferably monthly or weekly. In a general way the following items should be part of any preventive maintenance routine.

(1) Clean and dust thoroughly.

(2) Check primary voltage circuits.

(3) Measure all required voltages.

(4) Measure sensitivity of receivers.

(5) Check meter readings.

(6) Check dc control voltages.

(7) Measure frequency and amount of deviation of the transmitter.

(8) Check and adjust frequency netting of the entire system.

(9) Check all accessories, such as cables, fuses, etc.

(10) Check the antenna system and clean antenna of any dirt or corrosion.

(11) Check the transmission line connectors and repack the center cavities with silicone grease.

(12) Check intercabling lines, ac line, and antenna coaxial lines.

(13) Check power supply output voltages.

(14) Make an operational test of system performance.

(15) Keep individual records of each unit.

4. TROUBLESHOOTING

The crane is usually easily disabled by turning off the main contactor or by turning off the master control switches located at each motor contactor panel. When servicing the crane control system, it is best to use the PRC Crane Test Set.

If the receiver-decoder does not respond to any commands initiated by the control transmitter unit, it should first be determined whether the problem lies in the receiver-decoder or the control transmitter. The transmitter battery, receiver-decoder power supply and fuses should be checked first. The rf path between control transmitter and receiver can be checked by monitoring the receiver output as described in Receiver Alignment Procedure. Using an earphone, the two-tone output should be heard. The receiver itself may be checked using a Motorola Model S1056A-9A or TU546 Series Portable Test Set.

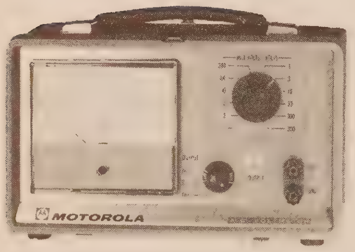
If the control transmitter to receiver rf path checks out properly, check to see that the operate relay is working. Also, check the activity relay located on the power panel. It should be operated at all times.

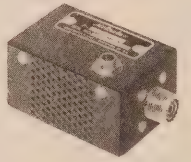
RECOMMENDED TEST EQUIPMENT

S1059A
Test Set

TEK-23
Power Supply

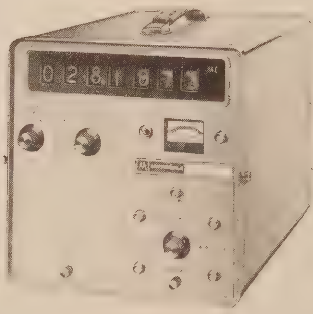
T1014B
Precision Wide Band
Oscilloscope


Transistorized AC
Voltmeter


P-7208-A
Dummy Load

DC Multimeter

T1035A or T1036A
Signal Generator


S1075B
Digital Frequency
Meter

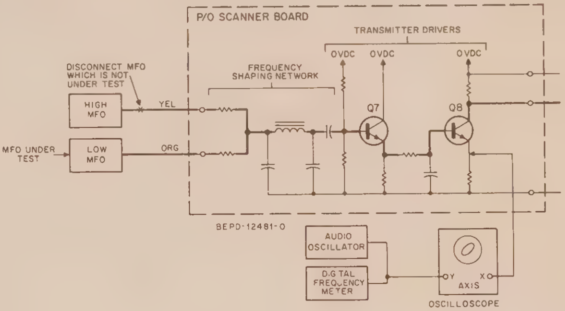
C1170A
PRC Crane
Test Set

The high and low MFO's of the control transmitter may be checked in the following manner (see Figure 1):

Disconnect from the scanner the MFO which is not under test. Set up an oscilloscope to display a Lissajou pattern. The output of the vertical axis should be connected to the emitter of Q8, the second transmitter driver. The horizontal axis should be connected to an audio oscillator, whose output is being monitored by a digital frequency meter. Adjust the audio oscillator so the exact tone frequency that is to be checked is shown on the digital frequency meter. Carefully adjust the audio oscillator so that the Lissajou pattern displayed indicates a 1 to 1 ratio. The frequency on the digital frequency meter is the frequency at which the MFO is operating. A background will be noted when the Lissajou pattern is displayed. This background is the other MFO audio frequency being displayed as the scanner runs through and can be disregarded.

A good VOM is a useful tool in troubleshooting the system where pulses are normally present and an oscilloscope is not available. An experienced technician will soon come to recognize a characteristic "wiggle" of the meter movement as an indication that pulses are present or if the "wiggle" is not present, that a circuit is not operating. It is even possible to determine by the amount of meter deflection whether more than one pulse per frame is present.

Each of the schematic diagrams in the service diagrams section has a voltage table which will greatly aid in troubleshooting. A voltage and waveform detail for the control transmitter is also included in this section.


P/O SCANNER BOARD
TRANSMITTER DRIVERS
0VDC
0VDC
0VDC
DISCONNECT MFO WHICH IS NOT UNDER TEST
FREQUENCY SHAPING NETWORK
HIGH MFO
YEL
Q7
Q8
MFO UNDER TEST
LOW MFO
ORG
BEPD-12481-0
AUDIO OSCILLATOR
DIGITAL FREQUENCY METER
Y
X
AXIS
OSCILLOSCOPE

5. RECEIVER-DECODER UNIT SERVICING MEASUREMENTS

The servicing measurements described in the following page(s) are to be used when the receiver-decoder unit is suspected in being at fault. The data shown includes test plugs, waveforms and voltages. To perform these measurements, the following Motorola test equipment was used:

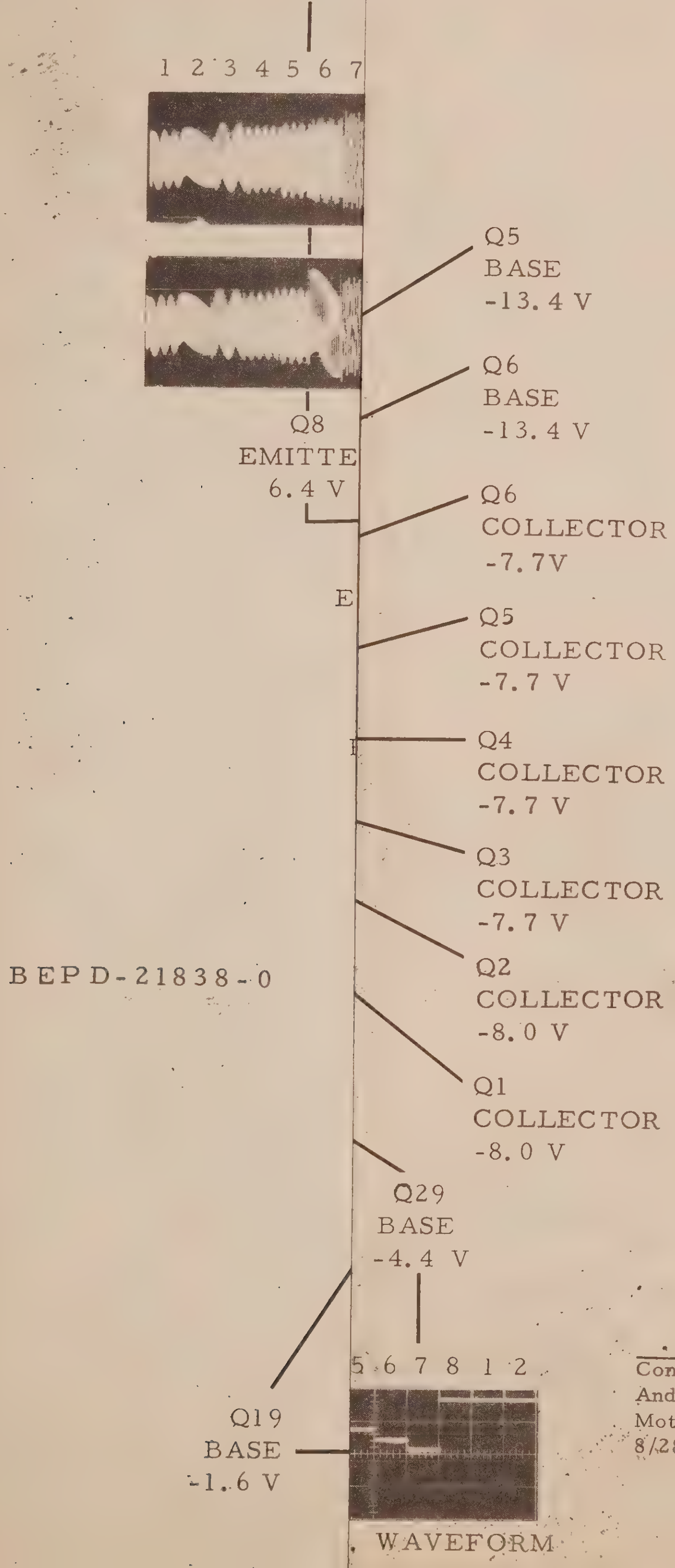
a. T1014B Wide Band Oscilloscope.

b. S1051C Transistorized AC Voltmeter.

c. S1052B DC Multimeter.

NOTE:

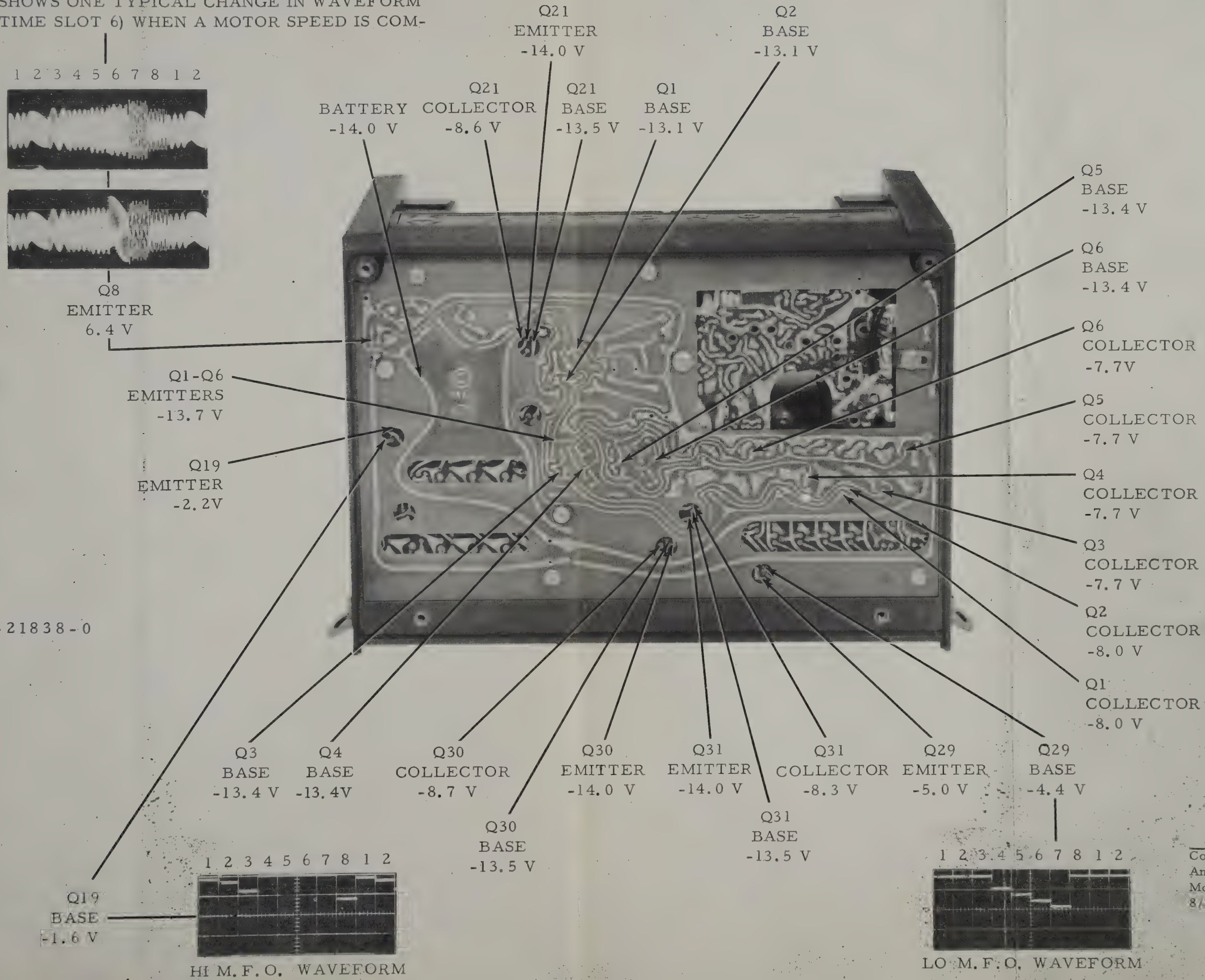
THESE WAVEFORMS ARE IDENTICA
TIME SLOT 6. THE UPPER TRACE E
WAVEFORM AT THIS POINT WITH A
LOWER WAVEFORM SHOWS ONE TY
(IN THIS EXAMPLE, TIME SLOT 6) V
MANDED.


1 2 3 4 5 6 7
Q5
BASE
-13.4 V
Q6
BASE
-13.4 V
Q8
EMITTE
6.4 V
Q6
COLLECTOR
-7.7V
E
Q5
COLLECTOR
-7.7 V
Q4
COLLECTOR
-7.7 V
Q3
COLLECTOR
-7.7 V
BEPD-21838-0
Q2
COLLECTOR
-8.0 V
Q1
COLLECTOR
-8.0 V
Q29
BASE
-4.4 V
5 6 7 8 1 2
Q19
BASE
-1.6 V
WAVEFORM

Control Transmitter Voltage
And Waveform Detail
Motorola No. BEPD-21838-O
8/28/68-RS

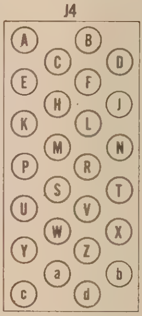
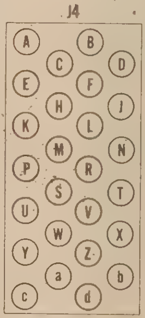
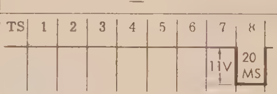
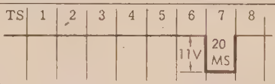
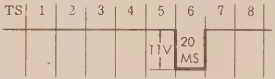
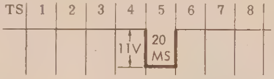
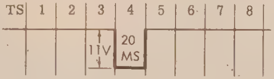
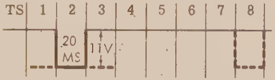
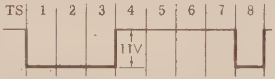
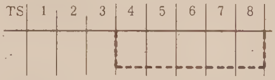
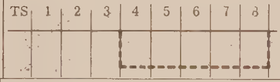
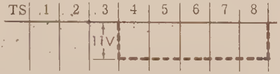
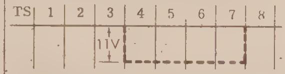
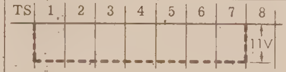
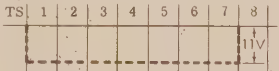
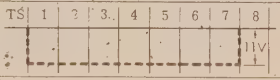
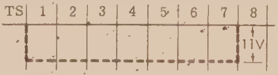
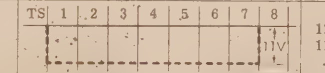
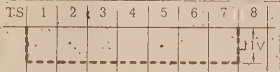
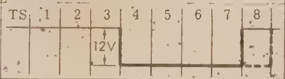
NOTE:

THESE WAVEFORMS ARE IDENTICAL WITH THE EXCEPTION OF TIME SLOT 6. THE UPPER TRACE EXHIBITS THE TYPICAL AUDIO WAVEFORM AT THIS POINT WITH ALL MOTORS STOPPED; THE LOWER WAVEFORM SHOWS ONE TYPICAL CHANGE IN WAVEFORM (IN THIS EXAMPLE, TIME SLOT 6) WHEN A MOTOR SPEED IS COMMANDED.


1 2 3 4 5 6 7 8 1 2
Q8 EMITTER 6.4 V
BATTERY -14.0 V
Q21 COLLECTOR -8.6 V
Q21 EMITTER -14.0 V
Q21 BASE -13.5 V
Q1 BASE -13.1 V
Q2 BASE -13.1 V
Q5 BASE -13.4 V
Q6 BASE -13.4 V
Q6 COLLECTOR -7.7V
Q5 COLLECTOR -7.7 V
Q4 COLLECTOR -7.7 V
Q3 COLLECTOR -7.7 V
Q2 COLLECTOR -8.0 V
Q1 COLLECTOR -8.0 V
Q1-Q6 EMITTERS -13.7 V
Q19 EMITTER -2.2V
BEPD-21838-0
Q3 BASE -13.4 V
Q4 BASE -13.4V
Q30 COLLECTOR -8.7 V
Q30 EMITTER -14.0 V
Q31 EMITTER -14.0 V
Q31 COLLECTOR -8.3 V
Q29 EMITTER -5.0 V
Q29 BASE -4.4 V
Q30 BASE -13.5 V
Q31 BASE -13.5 V
Q19 BASE -1.6 V
1 2 3 4 5 6 7 8 1 2
HI M.F.O. WAVEFORM
1 2 3 4 5 6 7 8 1 2
LO M.F.O. WAVEFORM

Control Transmitter Voltage
And Waveform Detail
Motorola No. BEPD-21838-0
8/28/68-RS

SERVICING MEASUREMENTS AVAILABLE AT TEST PLUG J4

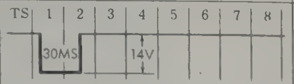
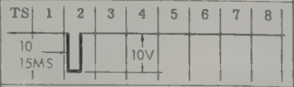
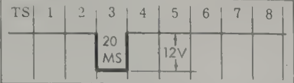
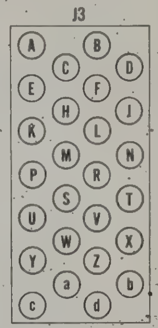
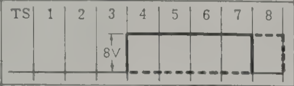
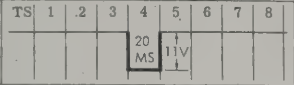
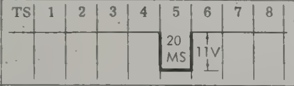
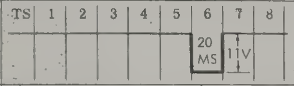
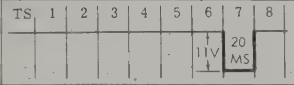
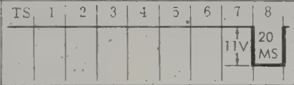
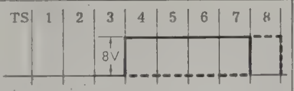
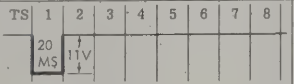
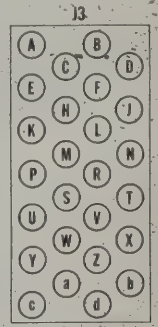
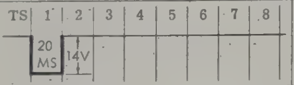
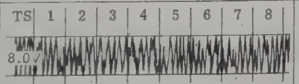
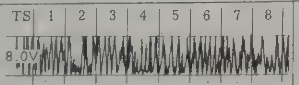
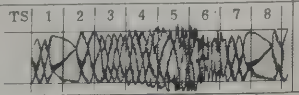
J4 PIN#	FUNCTION	OSCILLOSCOPE	D.C. METER	NOTES & INSTRUCTIONS	PLUG DIAGRAM
A	B+	—	14.0VDC	—	J4  A B C D E F H J K L M N P R S T U V W X Y Z a b c d J4  A B C D E F H J K L M N P R S T U V W X Y Z a b c d
B	GROUND	—	—	—	
D	TONE A (MAGNET) L. T. DEC. 490~	 TS 1 2 3 4 5 6 7 8 11V 20 MS	12.5V STANDBY 11.5V* ACTIVE	KEY TRANSMITTER. ACTUATE MAGNET/GRAPPLE. APPEARS IN TS-8	
E	TONE B (AUX. HOIST) L. T. DEC. 620~	 TS 1 2 3 4 5 6 7 8 11V 20 MS	12.5V STANDBY 11.5V* ACTIVE	KEY TRANSMITTER. ACTUATE AUX. HOIST. APPEARS IN TS-7	
F	TONE C (HOIST) L. T. DEC. 750~	 TS 1 2 3 4 5 6 7 8 11V 20 MS	12.5V STANDBY 11.5V* ACTIVE	KEY TRANSMITTER. ACTUATE HOIST. APPEARS IN TS-6	
H	TONE D (TROLLEY) L. T. DEC. 880~	 TS 1 2 3 4 5 6 7 8 11V 20 MS	12.5V STANDBY 11.5V* ACTIVE	KEY TRANSMITTER. ACTUATE TROLLEY. APPEARS IN TS-5	
J	TONE E (BRIDGE) L. T. DEC. 1010~	 TS 1 2 3 4 5 6 7 8 11V 20 MS	12.5V STANDBY 11.5V* ACTIVE	KEY TRANSMITTER. ACTUATE BRIDGE. APPEARS IN TS-4	
K	TONE F (ON) L. T. DEC. 1140~	 TS 1 2 3 4 5 6 7 8 20 MS 11V	12.5V STANDBY ① 11.5V* ACTIVE ACTIVE VOLT. WILL DROP IV/TS ENABLED	KEY TRANSMITTER. ACTUATE PROPER AUXILIARY. WILL APPEAR IN TS-1, 2, 3 AND SOMETIMES 8	
L	TONE G (OFF) L. T. DEC. 1270~	 TS 1 2 3 4 5 6 7 8 11V	12.5V STANDBY ① 11.5V* ACTIVE ACTIVE VOLT. WILL DROP IV/TS ENABLED	KEY TRANSMITTER. ALL AUXILIARIES OFF WILL APPEAR IN TS 1, 2, 3 & 8	
M	TONE H FS1 & MAG ON H. T. DEC. 1530~	 TS 1 2 3 4 5 6 7 8	12.5V STANDBY 11.5V* ACTIVE ①	KEY TRANSMITTER. ACTUATE FS1 AND/OR MAG ON MAY APPEAR IN TS 4, 5, 6, 7 & 8	
N	TONE J RS1 & MAG OFF H. T. DEC. 1660~	 TS 1 2 3 4 5 6 7 8	12.5V STANDBY 11.5V* ACTIVE ①	KEY TRANSMITTER. ACTUATE RS1 AND/OR MAG OFF MAY APPEAR IN TS 4, 5, 6, 7 & 8	
P	TONE K FS2 & TS8 AUX. H. T. DEC. 1770~	 TS 1 2 3 4 5 6 7 8 11V	12.5V STANDBY 11.5V* ACTIVE ①	KEY TRANSMITTER. ACTUATE FS2, MAY APPEAR IN TS-4, 5, 6, 7 & 8	
R	TONE L RS2 H. T. DEC. 1920~	 TS 1 2 3 4 5 6 7 8 11V	12.5V STANDBY 11.5V* ACTIVE ①	KEY TRANSMITTER. ACTUATE RS2. MAY APPEAR IN TS-4, 5, 6, 7	
S	TONE M FS3 & ADDRESS H. T. DEC. 2050~	 TS 1 2 3 4 5 6 7 8 11V	12.5V STANDBY 11.5V* ACTIVE ①	KEY TRANSMITTER. ACTUATE FS3. MAY APPEAR IN TS-1, 2, 3, 4, 5, 6, 7	
T	TONE N RS3 & ADDRESS H. T. DEC. 2130~	 TS 1 2 3 4 5 6 7 8 11V	12.5V STANDBY 11.5V* ACTIVE ①	KEY TRANSMITTER. ACTUATE RS3. MAY APPEAR IN TS-1, 2, 3, 4, 5, 6, 7	
U	TONE P FS4 & ADDRESS H. T. DEC. 2310~	 TS 1 2 3 4 5 6 7 8 11V	12.5V STANDBY 11.5V* ACTIVE ①	KEY TRANSMITTER. ACTUATE FS4. MAY APPEAR IN TS-1, 2, 3, 4, 5, 6, 7	
V	TONE R RS4 & ADDRESS H. T. DEC. 2440~	 TS 1 2 3 4 5 6 7 8 11V	12.5V STANDBY 11.5V* ACTIVE ①	KEY TRANSMITTER. ACTUATE RS4. MAY APPEAR IN TS-1, 2, 3, 4, 5, 6, 7	
W	TONE S FS5 & ADDRESS H. T. DEC. 2570~	 TS 1 2 3 4 5 6 7 8 11V	12.5V STANDBY 11.5V* ACTIVE ①	KEY TRANSMITTER. ACTUATE FS5. MAY APPEAR IN TS-1, 2, 3, 4, 5, 6, 7	
X	TONE T RS5 & ADDRESS H. T. DEC. 2700~	 TS 1 2 3 4 5 6 7 8 11V	12.5V STANDBY 11.5V* ACTIVE ①	KEY TRANSMITTER. ACTUATE RS5. MAY APPEAR IN TS-1, 2, 3, 4, 5, 6, 7	
Y	TONE U NEUTRAL H. T. DEC. 2830~	 TS 1 2 3 4 5 6 7 8 12V	13.0V STANDBY 8.0V* ACTIVE † ②	KEY TRANSMITTER, ALL PADDLES TO NEUTRAL. WILL APPEAR IN TS-4, 5, 6, 7 & 8 †	
Z	LOW GROUP TEST			SAME AS J3-Z	
a	HIGH GROUP TEST			SAME AS J3-a	
b	HIGH LIMITER			SAME AS J3-b	
c	LOW LIMITER			SAME AS J3-c	
d	RECEIVER AUDIO			SAME AS J3-d	

OSCILLOSCOPE MAY BE TRIGGERED FROM TS-1 (J3-V)   * INDICATES METER NEEDLE PULSING.   † CODE CHECK, J3-U AND TONE U J4-Y AND ADDRESS VERIFIER ENABLE J3-J ARE USED IN TIME SLOT 8 IN ONLY ONE CASE WHICH IS THE HOOK-ROTATE FUNCTION.

① ACTIVE VOLTAGE WILL DROP 1 VOLT ADDITIONAL COMMAND. ② ACTIVE VOLTAGE WILL RISE 1 VOLT MOTOR COMMAND.

SERVICE DIAGRAMS
AND
ALIGNMENT CHARTS

SERVICING MEASUREMENTS AVAILABLE AT TEST PLUG J3

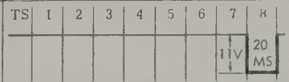
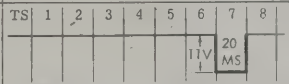
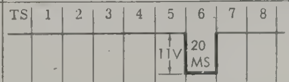
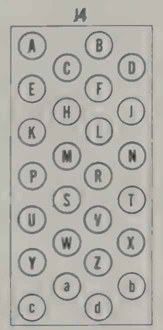
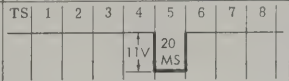
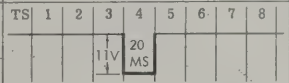
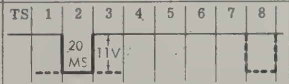
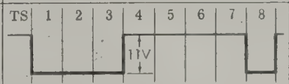
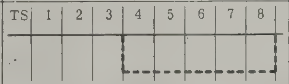
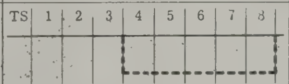
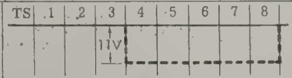
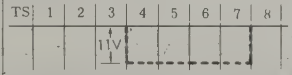
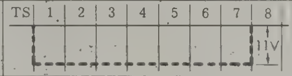
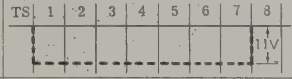
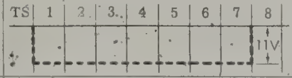
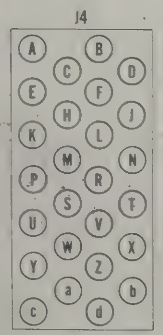
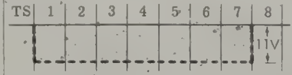
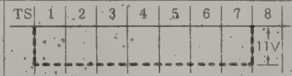
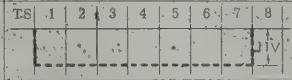
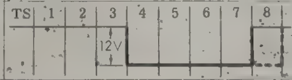
J3 PIN#	FUNCTION	OSCILLOSCOPE	D.C. METER	NOTES & INSTRUCTIONS	PLUG DIAGRAM
A	B+	—	14.0VDC	—	
B	GROUND	—	—	—	
D	ADDRESS MONOSTABLE AD. VER.	 TS 1 2 3 4 5 6 7 8 30MS 14V	13.0V STANDBY 11.0V* ACTIVE	KEY TRANSMITTER. PULSE APPEARS IN PARTS OF TS-1 & TS-2	
E	ADDRESS GATE 2 (SEQUENCE VERIFIER SYNC) AD. VER.	 TS 1 2 3 4 5 6 7 8 10 15MS 10V	12.8V STANDBY 12.0V* ACTIVE	KEY TRANSMITTER. PULSE APPEARS IN TS-2	
F	ADDRESS GATE 3 AD. VER.	 TS 1 2 3 4 5 6 7 8 20 MS 12V	13.0V STANDBY 11.5V* ACTIVE	KEY TRANSMITTER. PULSE APPEARS IN TS-3	 J3 A B C D E F H J K L M N P R S T U V W X Y Z a b c d
J	ADDRESS VERIFIER ENABLE - TS-4, 5, 6, 7 AND 8† AD. VER.	 TS 1 2 3 4 5 6 7 8 8V	10.7V STANDBY 5.7V* ACTIVE WILL DROP IV/T.S. ENABLED	KEY TRANSMITTER. WAVEFORM SHOWS NO T.S. ENABLED. SPECIFIC COMMAND WILL PRODUCE ENABLE	
K	TIME SLOT 4 (BRIDGE) S. V.	 TS 1 2 3 4 5 6 7 8 20 MS 11V	12.2V STANDBY 11.2V* ACTIVE	KEY TRANSMITTER AND MOVE BRIDGE PADDLE OFF NEUTRAL	
L	TIME SLOT 5 (TROLLEY) S. V.	 TS 1 2 3 4 5 6 7 8 20 MS 11V	12.2V STANDBY 11.2V* ACTIVE	KEY TRANSMITTER AND MOVE TROLLEY PADDLE OFF NEUTRAL	
M	TIME SLOT 6 (HOIST) S. V.	 TS 1 2 3 4 5 6 7 8 20 MS 11V	12.2V STANDBY 11.2V* ACTIVE	KEY TRANSMITTER AND MOVE HOIST PADDLE OFF NEUTRAL	
N	TIME SLOT 7 (AUX. HOIST) S. V.	 TS 1 2 3 4 5 6 7 8 11V 20 MS	12.2V STANDBY 11.2V* ACTIVE	KEY TRANSMITTER AND MOVE AUX. HOIST PADDLE OFF NEUTRAL	
P	TIME SLOT 8 MAGNET OR GRAPPLE S. V.	 TS 1 2 3 4 5 6 7 8 11V 20 MS	12.2V STANDBY 11.2V* ACTIVE	KEY TRANSMITTER AND COMMAND HOOK ROTATE IF APPLICABLE	
R	LOW GROUP CHECK L. T. DEC.	—	3.9V STANDBY 13.0V ACTUATED	KEY TRANSMITTER AND GROUND J3-2 FOR TEST ACTUATION, (SYSTEM WILL BE DISABLED)	
S	HIGH GROUP CHECK H. T. DEC.	—	3.9V STANDBY 13.0V ACTUATED	KEY TRANSMITTER AND GROUND J3-a FOR TEST ACTUATION. SYSTEM WILL BE DISABLED	
U	CODE CHECK H. T. DEC.	 TS 1 2 3 4 5 6 7 8 8V	3.0V STANDBY † 6.2V* ACTIVE	KEY TRANSMITTER. WAVEFORM SHOWS CODE CHECK IN TS-4, 5, 6, 7 & 8 MOVE ANY PADDLE OFF NEUTRAL AND CODE CHECK SHOULD BE REMOVED FROM THAT TIME SLOT †	
V	TIME SLOT 1 S. V.	 TS 1 2 3 4 5 6 7 8 20 MS 11V	1.7V STANDBY (12.2 STANDBY) 11.2* ACTIVE	KEY TRANSMITTER. DC. VM READING MAY BE 12.2VDC AT TURN ON DUE TO RANDOM S. V. BISTABLE SETUP	 J3 A B C D E F H J K L M N P R S T U V W X Y Z a b c d
W	START, STOP BISTABLE S. V.	 TS 1 2 3 4 5 6 7 8 20 MS 14V	0.18V STANDBY 11.5V* ACTIVE	KEY TRANSMITTER. BISTABLE "STARTS" IN TS-2 AND "STOPS" IN TS-1	
Z	LOW GROUP TEST	—	—	USE IN CONJUNCTION WITH J3-R GROUND FOR TEST	
a	HIGH GROUP TEST	—	—	USE IN CONJUNCTION WITH J3-S GROUND FOR TEST	
b	HIGH LIMITER LIM. & FIL. DK	 TS 1 2 3 4 5 6 7 8 8.0V	3.2VAC	KEY TRANSMITTER	
c	LOW LIMITER LIM. & FIL. DK	 TS 1 2 3 4 5 6 7 8 8.0V	3.2VAC	KEY TRANSMITTER	
d	RECEIVER AUDIO RX	 TS 1 2 3 4 5 6 7 8	0.4VAC SIGNAL 0.9VAC NOISE	KEY TRANSMITTER FOR SIGNAL WAVEFORM SHOWN IS WITH SIGNAL	

OSCILLOSCOPE MAY BE TRIGGERED FROM TIME SLOT 1 (J3-V).

* INDICATES METER NEEDLE PULSING

† CODE CHECK, J3-U AND TONE U J4-Y AND ADDRESS VERIFIER ENABLE J3-J ARE USED IN TIME SLOT 8 IN ONLY ONE CASE WHICH IS THE HOOK-ROTATE FUNCTION.

SERVICING MEASUREMENTS AVAILABLE AT TEST PLUG J4

J4 PIN#	FUNCTION	OSCILLOSCOPE	D.C. METER	NOTES & INSTRUCTIONS	PLUG DIAGRAM
A	B+	—	14.0VDC	—	
B	GROUND	—	—	—	
D	TONE A (MAGNET) L. T. DEC. 490~	 TS 1 2 3 4 5 6 7 8 11V 20 MS	12.5V STANDBY 11.5V* ACTIVE	KEY TRANSMITTER. ACTUATE MAGNET/GRAPPLE, APPEARS IN TS-8	
E	TONE B (AUX. HOIST) L. T. DEC. 620~	 TS 1 2 3 4 5 6 7 8 11V 20 MS	12.5V STANDBY 11.5V* ACTIVE	KEY TRANSMITTER. ACTUATE AUX. HOIST, APPEARS IN TS-7	
F	TONE C (HOIST) L. T. DEC. 750~	 TS 1 2 3 4 5 6 7 8 11V 20 MS	12.5V STANDBY 11.5V* ACTIVE	KEY TRANSMITTER. ACTUATE HOIST, APPEARS IN TS-6	 J4 A B C D E F H J K L M N P R S T U V W X Y Z a b c d
H	TONE D (TROLLEY) L. T. DEC. 880~	 TS 1 2 3 4 5 6 7 8 11V 20 MS	12.5V STANDBY 11.5V* ACTIVE	KEY TRANSMITTER ACTUATE TROLLEY, APPEARS IN TS-5	
J	TONE E (BRIDGE) L. T. DEC. 1010~	 TS 1 2 3 4 5 6 7 8 11V 20 MS	12.5V STANDBY 11.5V* ACTIVE	KEY TRANSMITTER. ACTUATE BRIDGE, APPEARS IN TS-4	
K	TONE F (ON) L. T. DEC. 1140~	 TS 1 2 3 4 5 6 7 8 20 MS 11V	12.5V STANDBY ① 11.5V* ACTIVE ACTIVE VOLT. WILL DROP IV/TS ENABLED	KEY TRANSMITTER. ACTUATE PROPER AUXILIARY. WILL APPEAR IN TS-1, 2, 3 AND SOMETIMES 8	
L	TONE G (OFF) L. T. DEC. 1270~	 TS 1 2 3 4 5 6 7 8 11V	12.5V STANDBY ① 11.5V* ACTIVE ACTIVE VOLT. WILL DROP IV/TS ENABLED	KEY TRANSMITTER. ALL AUXILIARIES OFF WILL APPEAR IN TS 1, 2, 3 & 8	
M	TONE H FS1 & MAG ON H. T. DEC. 1530~	 TS 1 2 3 4 5 6 7 8	12.5V STANDBY ① 11.5V* ACTIVE	KEY TRANSMITTER. ACTUATE FS1 AND/OR MAG ON MAY APPEAR IN TS 4, 5, 6, 7 & 8	
N	TONE J RS1 & MAG OFF H. T. DEC. 1660~	 TS 1 2 3 4 5 6 7 8	12.5V STANDBY ① 11.5V* ACTIVE	KEY TRANSMITTER. ACTUATE RS1 AND/OR MAG OFF MAY APPEAR IN TS 4, 5, 6, 7 & 8	
P	TONE K FS2 & TS8, AUX. H. T. DEC. 1770~	 TS 1 2 3 4 5 6 7 8 11V	12.5V STANDBY ① 11.5V* ACTIVE	KEY TRANSMITTER. ACTUATE FS2, MAY APPEAR IN TS-4, 5, 6, 7 & 8	
R	TONE L RS2 H. T. DEC. 1[illegible]20~	 TS 1 2 3 4 5 6 7 8 11V	12.5V STANDBY ① 11.5V* ACTIVE	KEY TRANSMITTER. ACTUATE RS2, MAY APPEAR IN TS-4, 5, 6, 7	
S	TONE M FS3 & ADDRESS H. T. DEC. 2050~	 TS 1 2 3 4 5 6 7 8 11V	12.5V STANDBY ① 11.5V* ACTIVE	KEY TRANSMITTER. ACTUATE FS3, MAY APPEAR IN TS-1, 2, 3, 4, 5, 6, 7	
T	TONE N RS3 & ADDRESS H. T. DEC. 2130~	 TS 1 2 3 4 5 6 7 8 11V	12.5V STANDBY ① 11.5V* ACTIVE	KEY TRANSMITTER. ACTUATE RS3, MAY APPEAR IN TS-1, 2, 3, 4, 5, 6, 7	
U	TONE P FS4 & ADDRESS H. T. DEC. 2310~	 TS 1 2 3 4 5 6 7 8 11V	12.5V STANDBY ① 11.5V* ACTIVE	KEY TRANSMITTER. ACTUATE FS4, MAY APPEAR IN TS-1, 2, 3, 4, 5, 6, 7	 J4 A B C D E F H J K L M N P R S T U V W X Y Z a b c d
V	TONE R RS4 & ADDRESS H. T. DEC. 2440~	 TS 1 2 3 4 5 6 7 8 11V	12.5V STANDBY ① 11.5V* ACTIVE	KEY TRANSMITTER. ACTUATE RS4, MAY APPEAR IN TS-1, 2, 3, 4, 5, 6, 7	
W	TONE S FS5 & ADDRESS H. T. DEC. 2570~	 TS 1 2 3 4 5 6 7 8 11V	12.5V STANDBY ① 11.5V* ACTIVE	KEY TRANSMITTER. ACTUATE FS5, MAY APPEAR IN TS-1, 2, 3, 4, 5, 6, 7	
X	TONE T RS5 & ADDRESS H. T. DEC. 2700~	 TS 1 2 3 4 5 6 7 8 11V	12.5V STANDBY ① 11.5V* ACTIVE	KEY TRANSMITTER. ACTUATE RS5, MAY APPEAR IN TS-1, 2, 3, 4, 5, 6, 7	
Y	TONE U NEUTRAL H. T. DEC. 2830~	 TS 1 2 3 4 5 6 7 8 12V	13.0V STANDBY † ② 8.0V* ACTIVE	KEY TRANSMITTER, ALL PADDLES TO NEUTRAL. WILL APPEAR IN TS-4, 5, 6, 7 & 8 †	
Z	LOW GROUP TEST			SAME AS J3-Z	
a	HIGH GROUP TEST			SAME AS J3-a	
b	HIGH LIMITER			SAME AS J3-b	
c	LOW LIMITER			SAME AS J3-c	
d	RECEIVER AUDIO			SAME AS J3-d	

OSCILLOSCOPE MAY BE TRIGGERED FROM TS-1 (J3-V)

* INDICATES METER NEEDLE PULSING.

† CODE CHECK, J3-U AND TONE U J4-Y AND ADDRESS VERIFIER ENABLE J3-J ARE USED IN TIME SLOT 8 IN ONLY ONE CASE WHICH IS THE HOOK-ROTATE FUNCTION.

① ACTIVE VOLTAGE WILL DROP 1 VOLT ADDITIONAL COMMAND. ② ACTIVE VOLTAGE WILL RISE 1 VOLT MOTOR COMMAND.

SERVICE DIAGRAMS
AND
ALIGNMENT CHARTS

CONTROL TRANSMITTER UNITS

PAGE

Control Transmitter Alignment Procedure 9-1
Control Transmitter Unit Functional Block Diagram 9-3
Auxiliary Function Switch Kits Location and Wiring Detail 9-5
Control Transmitter and Encoder Schematic Diagram 9-7
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Scanner Circuit Board Detail 9-15

ALIGNMENT

in sequence. Do not return to a previous ry return all slugs, except L101, to 1/16-again at step 1 of the procedure. Also, ones found as the slugs are turned clock-

PROCEDURE
ransmitter momentarily and adjust the power supply voltage to 13 volts d-c.
102 and L103 for maximum readings. Repeak several times to obtain maximum This circuit is tuned to three times the crystal frequency. NOTE: L101 has sted during the final factory test of the transmitter. It should not be retuned.
ils L104 and L105 for a maximum reading. Repeak several times to obtain reading. This circuit is tuned to nine times the crystal frequency.
ils L106 and L107 for a maximum reading. Repeak several times to obtain reading. In repeaking be careful not to move to a new peak, as these coils e two.
110 and L111 for maximum output. Repeak several times for maximum output nimizing the input current. Now repeak L106, L107, L110 and L111, in that r maximum power while minimizing the current drain. Repeat until the watt- longer increases. Increase the supply voltage to 14. 0 volts. The output power at least 100 milliwatts (425 mw if jumper JU102 is connected). O NOT EXCEED 105 MA TOTAL CURRENT DRAIN FOR 100 MILLIWATT UNITS A FOR 500 MILLIWATT UNITS.
TOR: C101 is preset to the assigned frequency at the factory. Do not readjust ess the crystal is replaced or the setting was accidentally changed. ecessary to readjust C101, set up the frequency monitor for frequency measure-d adjust C101 for zero reading on the monitor CARRIER FREQUENCY meter. back plate on the transmitter unit and tighten securely. **NT** - When the cover plate is attached, the frequency may shift, therefore the carrier frequency on the frequency monitor. If necessary, repeat this nt and recheck procedure compensating for the variations until a zero meter s obtained with back cover securely attached to unit.
the wattmeter and reconnect the antenna. Replace the circuit board in the hous-eplace the bottom plate. Remove the battery shield from the back of the housing. st set selector switch to position 14 and place the rf probe near the antenna. Key mitter and adjust the antenna trimmer for maximum meter reading. This peak is rp. **NT** - Circuit board must be in housing with bottom plate on when adjusting trimmer.

PAGE

CONTROL TRANSMITTER UNITS

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Scanner Circuit Board Detail 9-15

A. TEST EQUIPMENT REQUIRED

1. Motorola NLN6245A Tuning Tool Kit (supplied) or equivalent.
2. Motorola DC Multimeter with r-f probe or equivalent.
3. RF Wattmeter (50-ohm impedance).
4. Motorola TEK-23 Power Supply or equivalent.
5. Motorola Model T1130A Series FM Station Monitor or equivalent.
6. Ammeter (0-0.5 amp scale).
7. Motorola S1056A-9A Series Portable Test Set or field strength meter.

B. NOMINAL VOLTAGE READINGS

NOTE

The following readings apply to a fully tuned transmitter with a 14.2 v d-c input.

METER POINT	M1 BRN	M2 RED	M3 YEL
READING (VDC)	-3.0	-3.2	-0.9*

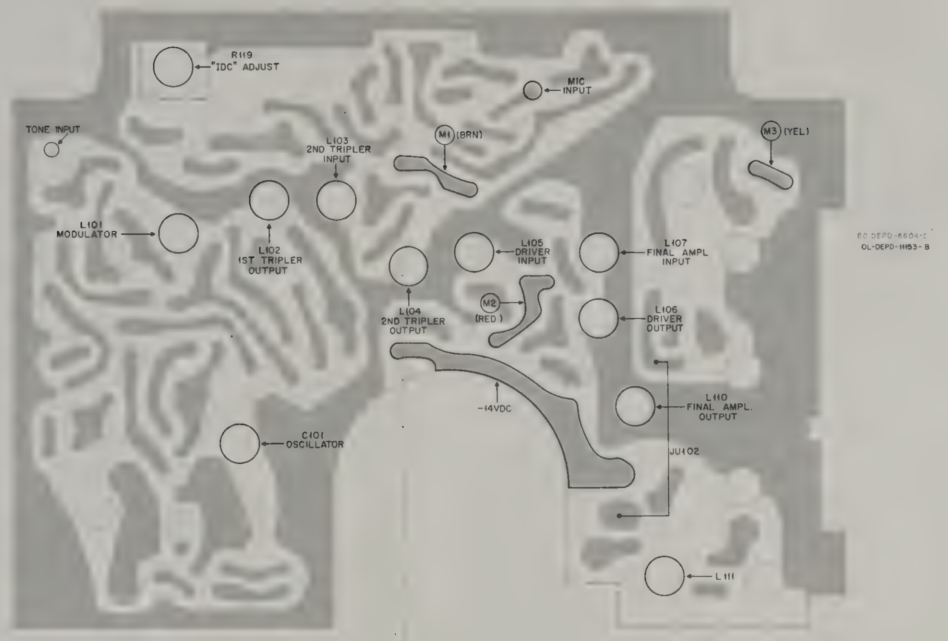
* MEASUREMENT MADE WITH RF PROBE)

C. PRELIMINARY SET-UP FOR TRANSMITTER ALIGNMENT

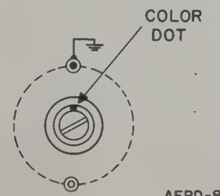
1. Turn the unit over and remove the bottom plate.
2. For complete alignment, the battery should be removed and a 14.2 volt d-c power supply and ammeter connected to the transmitter board. Remove power to scanner by removing the black wire on transmitter board. All tuning slugs, except L101, should be unscrewed so they protrude 1/16 inch above the printed circuit board.
3. Unsolder the antenna from the transmitter circuit board, and connect the wattmeter in place of the antenna with a short piece of 50 ohm coaxial cable.

D. FREQUENCY CALCULATION

$f_0 \doteq \frac{f_c}{9}$ where: f_0 = oscillator frequency and
f_c carrier frequency



Metering and Alignment Points



AEPD-8291-0

NOTE

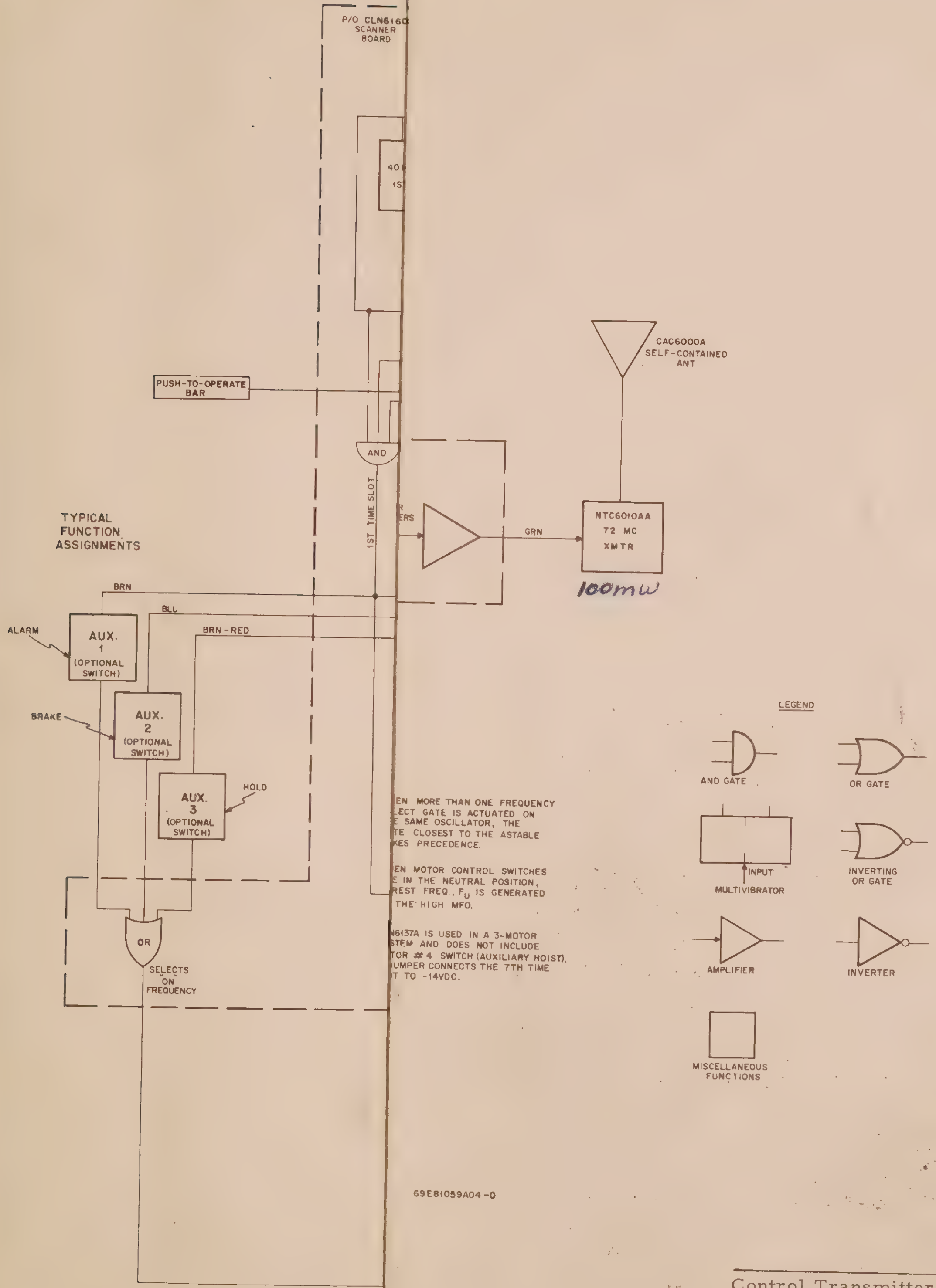
To adjust C101 or C201 for maximum capacity, turn screwdriver slot so color dot is nearest the grounded side of the capacitor.

E. TRANSMITTER ALIGNMENT

NOTE

Perform each step of the following procedure in sequence. Do not return to a previous step and repeak. Should this become necessary return all slugs, except L101, to 1/16-inch above the printed circuit board and begin again at step 1 of the procedure. Also, some coils may have two peaks. Use the first ones found as the slugs are turned clockwise from 1/16 inch above their forms.

STEP	TEST EQUIPMENT	METER POINT & COLOR	ADJUSTMENT	PROCEDURE
1	--	--	--	Key the transmitter momentarily and adjust the power supply voltage to 13 volts d-c.
2	DC Multimeter	M1 (BRN)	L102, L103 1st Tripler	Adjust L102 and L103 for maximum readings. Repeak several times to obtain maximum reading. This circuit is tuned to three times the crystal frequency. NOTE: L101 has been adjusted during the final factory test of the transmitter. It should not be retuned.
3	DC Multimeter	M2 (RED)	L104, L105 2nd Tripler	Adjust coils L104 and L105 for a maximum reading. Repeak several times to obtain maximum reading. This circuit is tuned to nine times the crystal frequency.
4	DC Multimeter with rf probe	M3 (YEL)	L106, L107 Driver	Adjust coils L106 and L107 for a maximum reading. Repeak several times to obtain maximum reading. In repeaking be careful not to move to a new peak, as these coils may have two.
5	RF Wattmeter	--	--	Adjust L110 and L111 for maximum output. Repeak several times for maximum output while minimizing the input current. Now repeak L106, L107, L110 and L111, in that order, for maximum power while minimizing the current drain. Repeat until the wattmeter no longer increases. Increase the supply voltage to 14.0 volts. The output power should be at least 100 milliwatts (425 mw if jumper JU102 is connected). NOTE: DO NOT EXCEED 105 MA TOTAL CURRENT DRAIN FOR 100 MILLIWATT UNITS OR 135 MA FOR 500 MILLIWATT UNITS.
6	--	--	--	OSCILLATOR: C101 is preset to the assigned frequency at the factory. Do not readjust C101 unless the crystal is replaced or the setting was accidentally changed. If it is necessary to readjust C101, set up the frequency monitor for frequency measurement, and adjust C101 for zero reading on the monitor CARRIER FREQUENCY meter. Place the back plate on the transmitter unit and tighten securely. ***IMPORTANT*** - When the cover plate is attached, the frequency may shift, therefore recheck the carrier frequency on the frequency monitor. If necessary, repeat this adjustment and recheck procedure compensating for the variations until a zero meter reading is obtained with back cover securely attached to unit.
7	Portable Test Set (used as field strength meter)	--	Antenna Trimmer	Remove the wattmeter and reconnect the antenna. Replace the circuit board in the housing and replace the bottom plate. Remove the battery shield from the back of the housing. Set the test set selector switch to position 14 and place the rf probe near the antenna. Key the transmitter and adjust the antenna trimmer for maximum meter reading. This peak is very sharp. ***IMPORTANT*** - Circuit board must be in housing with bottom plate on when adjusting antenna trimmer.


P/O CLN6160
SCANNER
BOARD
40
(S
PUSH-TO-OPERATE
BAR
AND
1ST TIME SLOT
R
ERS
CAC6000A
SELF-CONTAINED
ANT
GRN
NTC6010AA
72 MC
XMTR
100mw
TYPICAL
FUNCTION
ASSIGNMENTS
BRN
BLU
BRN-RED
ALARM
AUX.
1
(OPTIONAL
SWITCH)
BRAKE
AUX.
2
(OPTIONAL
SWITCH)
HOLD
AUX.
3
(OPTIONAL
SWITCH)
OR
SELECTS
"ON"
FREQUENCY
LEGEND
AND GATE
OR GATE
INPUT
MULTIVIBRATOR
INVERTING
OR GATE
AMPLIFIER
INVERTER
MISCELLANEOUS
FUNCTIONS
69E81059A04-0

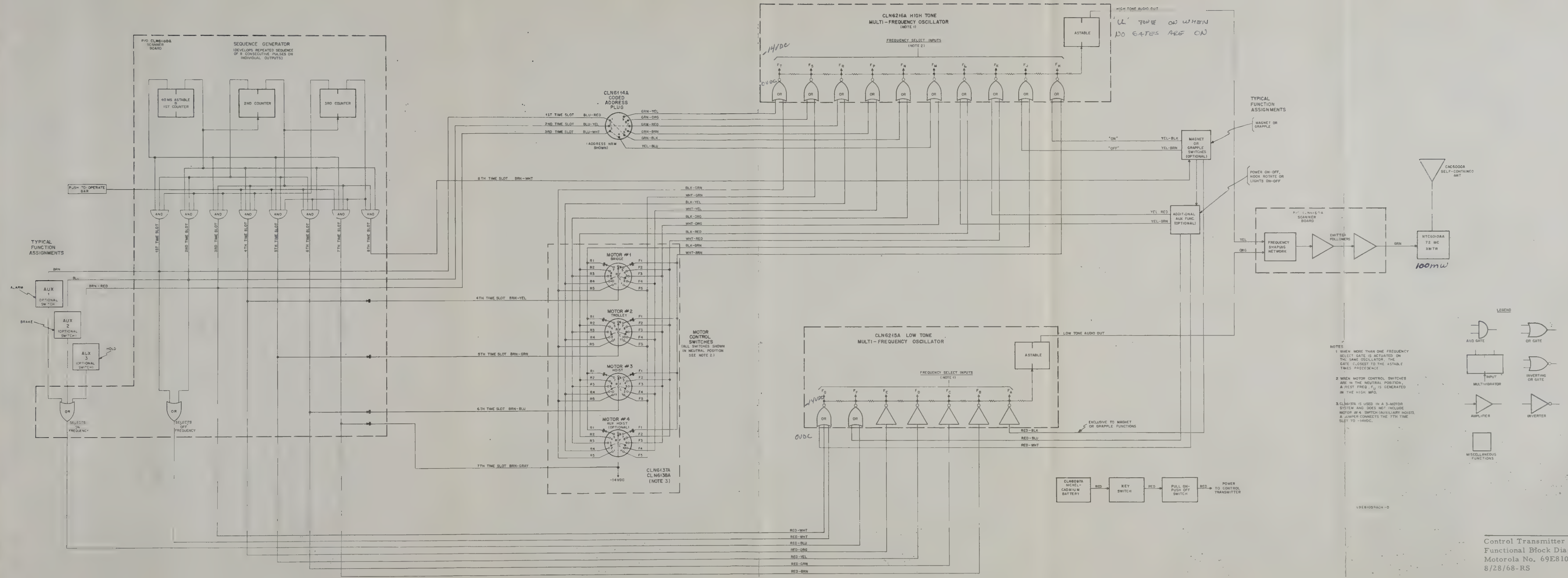
EN MORE THAN ONE FREQUENCY
LECT GATE IS ACTUATED ON
E SAME OSCILLATOR, THE
TE CLOSEST TO THE ASTABLE
KES PRECEDENCE.

EN MOTOR CONTROL SWITCHES
E IN THE NEUTRAL POSITION,
REST FREQ., F_U IS GENERATED
THE HIGH MFO.

N6137A IS USED IN A 3-MOTOR
STEM AND DOES NOT INCLUDE
TOR #4 SWITCH (AUXILIARY HOIST).
UMPER CONNECTS THE 7TH TIME
T TO -14VDC.

Control Transmitter Unit
Functional Block Diagram
Motorola No. 69E81059A04-O
8/28/68-RS

TX { HIGH = 0VDC
LOW = -14VDC


P/O CLN6160A
SCANNER
BOARD
SEQUENCE GENERATOR
(DEVELOPS REPEATED SEQUENCE
OF 8 CONSECUTIVE PULSES ON
INDIVIDUAL OUTPUTS)
40 MS ASTABLE
&
1ST COUNTER
2ND COUNTER
3RD COUNTER
PUSH TO-OPERATE
BAR
AND
1ST TIME SLOT
2ND TIME SLOT
3RD TIME SLOT
4TH TIME SLOT
5TH TIME SLOT
6TH TIME SLOT
7TH TIME SLOT
8TH TIME SLOT
TYPICAL
FUNCTION
ASSIGNMENTS
BRN
BLU
BRN - RED
ALARM
AUX
1
OPTIONAL
SWITCH
BRAKE
AUX
2
(OPTIONAL
SWITCH)
AUX
3
(OPTIONAL
SWITCH)
HOLD
OR
SELECTS
ON
FREQUENCY
SELECTS
OFF
FREQUENCY
CLN6114A
CODED
ADDRESS
PLUG
1ST TIME SLOT BLU-RED
2ND TIME SLOT BLU-YEL
3RD TIME SLOT BLU-WHT
(ADDRESS NRM
SHOWN)
GRN-YEL
GRN-ORG
GRN-RED
GRN-BRN
GRN-BLK
YEL-BLU
8TH TIME SLOT BRN-WHT
BLK-GRN
WHT-GRN
BLK-YEL
WHT-YEL
BLK-ORG
WHT-ORG
BLK-RED
WHT-RED
BLK-BRN
WHT-BRN
MOTOR #1
BRIDGE
MOTOR #2
TROLLEY
MOTOR #3
HOIST
MOTOR #4
AUX HOIST
(OPTIONAL)
R1
R2
R3
R4
R5
F1
F2
F3
F4
F5
R
F
C
4TH TIME SLOT BRN-YEL
5TH TIME SLOT BRN-GRN
6TH TIME SLOT BRN-BLU
7TH TIME SLOT BRN-GRAY
-14VDC
MOTOR
CONTROL
SWITCHES
(ALL SWITCHES SHOWN
IN NEUTRAL POSITION
SEE NOTE 2.)
CLN6137A
CLN6138A
(NOTE 3)
CLN6216A HIGH TONE
MULTI-FREQUENCY OSCILLATOR
(NOTE 1)
FREQUENCY SELECT INPUTS
(NOTE 2)
F_T
F_S
F_R
F_P
F_N
F_M
F_L
F_K
F_J
F_H
ASTABLE
-14VDC
OVDC
HIGH TONE AUDIO OUT
'U' TONE ON WHEN
NO GATES ARE ON
TYPICAL
FUNCTION
ASSIGNMENTS
MAGNET OR
GRAPPLE
"ON"
"OFF"
YEL-BLK
YEL-BRN
MAGNET
OR
GRAPPLE
SWITCHES
(OPTIONAL)
POWER ON-OFF,
HOOK ROTATE OR
LIGHTS ON-OFF
YEL RED
YEL-GRN
ADDITIONAL
AUX FUNC.
(OPTIONAL)
YEL
ORG
P/O CLN6160A
SCANNER
BOARD
FREQUENCY
SHAPING
NETWORK
EMITTER
FOLLOWERS
GRN
NTC6010AA
72 MC
XMTR
100mw
CAC6000A
SELF-CONTAINED
ANT
CLN6215A LOW TONE
MULTI-FREQUENCY OSCILLATOR
FREQUENCY SELECT INPUTS
(NOTE 1)
F_G
F_F
F_E
F_D
F_C
F_B
F_A
-14VDC
OVDC
ASTABLE
LOW TONE AUDIO OUT
EXCLUSIVE TO MAGNET
OR GRAPPLE FUNCTIONS
RED-BLK
RED-BLU
RED-WHT
RED-WHT
RED-WHT
RED-BLU
RED-ORG
RED-YEL
RED-GRN
RED-BRN
CLN6097A
NICKEL-
CADMIUM
BATTERY
RED
KEY
SWITCH
PULL ON-
PUSH OFF
SWITCH
POWER
TO CONTROL
TRANSMITTER
LEGEND
AND GATE
OR GATE
INPUT
MULTIVIBRATOR
INVERTING
OR GATE
AMPLIFIER
INVERTER
MISCELLANEOUS
FUNCTIONS
69E81059A04-0

NOTES

1. WHEN MORE THAN ONE FREQUENCY SELECT GATE IS ACTUATED ON THE SAME OSCILLATOR, THE GATE CLOSEST TO THE ASTABLE TAKES PRECEDENCE
2. WHEN MOTOR CONTROL SWITCHES ARE IN THE NEUTRAL POSITION, A REST FREQ. F_U IS GENERATED IN THE HIGH MFO.
3. CLN6137A IS USED IN A 3-MOTOR SYSTEM AND DOES NOT INCLUDE MOTOR #4 SWITCH (AUXILIARY HOIST). A JUMPER CONNECTS THE 7TH TIME SLOT TO -14VDC.

Control Transmitter Unit
Functional Block Diagram
Motorola No. 69E81059A04-O
8/28/68-RS

TX { High = OVDC

MAG
ON

CONTROL TRANSMITTE

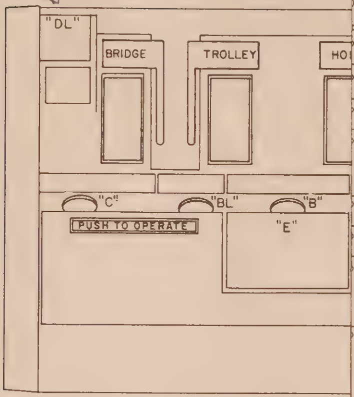


FIGURE 2
TOP VIEW

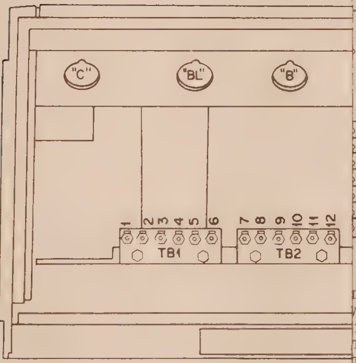


FIGURE 3
BACK VIEW

UNCTION SWITCH KIT WIRING AND LOCATION TABLE

CH EL	CONNECTS		SWITCH	
	This Color Wire	To This Terminal	POSITION	FUNCTION
075A	Red-Blu	5	A	ON-CRANE-OFF
	Wht-Blk	6		
076A	Red-Blu	5	A	ON-LIGHTS-OFF
	Wht-Blk	6		
077A	Red-Blu	5	A	BRAKE
	Blk-Wht	6		
170A	Wht-Blk	9	BR	BRAKE
	Red-Blu	10		
	#24 solid Jumper	11 12		
077A	Blk-Wht	1	C	BRAKE
	Red-Blu	2		
078A	Red-Blu	5	A	OPERATOR REL
	Blk-Wht	6		
078A	Blk-Wht	9	B	OPERATOR REL
	Red-Blu	10		
	#24 solid Jumper	11 12		
079A	Red-Wht	9	BR	HOOK RT
	Red-Blu	10		
	Red-Wht	11	BL	HOOK LT
	Yel-Red	12		
	Diode	10 12		
080A	Red-Blu	5	A	ON-HOLD-OFF
	Blk-Wht	6		
	Remove Jumper from 11 to 16			
081A	Red-Blk	15	DL	MAG
	Brn-Wht	16		
	Red-Wht	11		
	Yel-Blk	13	DR	MAG OFF
	Red-Blk	15		
	Yel-Brn	17		
	Remove Jumper from 11 to 16			
085A	Red-Blk	15	DL	GRIP
	Brn-Wht	16		
	Red-Wht	11		
	Yel-Blk	13	DR	GRIP OFF
	Red-Blk	15		
	Yel-Brn	17		
172A	Label Only		E	ALARM
086A	Connects to address socket on battery shield		A	CRANE SELECT (2)
086A			C	CRANE SELECT (2)
087A			A	CRANE SELECT (3)
087A			C	CRANE SELECT (3)
173A	Label Only		E	ALARM/RESET
174A	Label Only		E	RESET

TABLE GIVES THE WIRING AND LOCATIONS FOR EACH AUXILIARY ITCH KIT. THE WIRE COLORS REFER TO THE WIRES ON THE PPLIED AS PART OF THE KIT MODELS CALLED OUT. THE LO- THE NUMBERED TERMINALS ARE SHOWN IN FIGURE 1. THE TIONS ARE SHOWN IN FIGURES 2 AND 3.
REMOVED WHEN SWITCH "DL" AND "DR" IS USED.

EPD-11159-D

Auxiliary Function Switch Kits
Location and Wiring Detail
Motorola No. CEPD-11160-D
8/28/68-RS

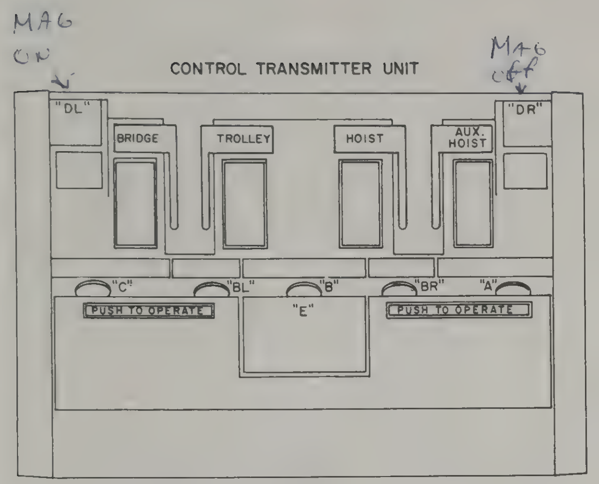

MAG
ON
Mag
off
CONTROL TRANSMITTER UNIT
"DL"
"DR"
BRIDGE
TROLLEY
HOIST
AUX. HOIST
"C"
"BL"
"B"
"BR"
"A"
PUSH TO OPERATE
"E"
PUSH TO OPERATE

FIGURE 2
TOP VIEW

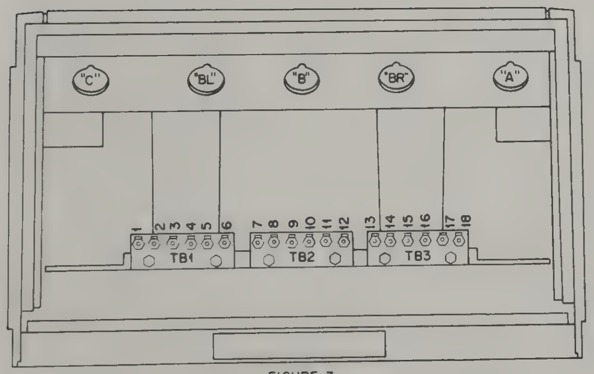
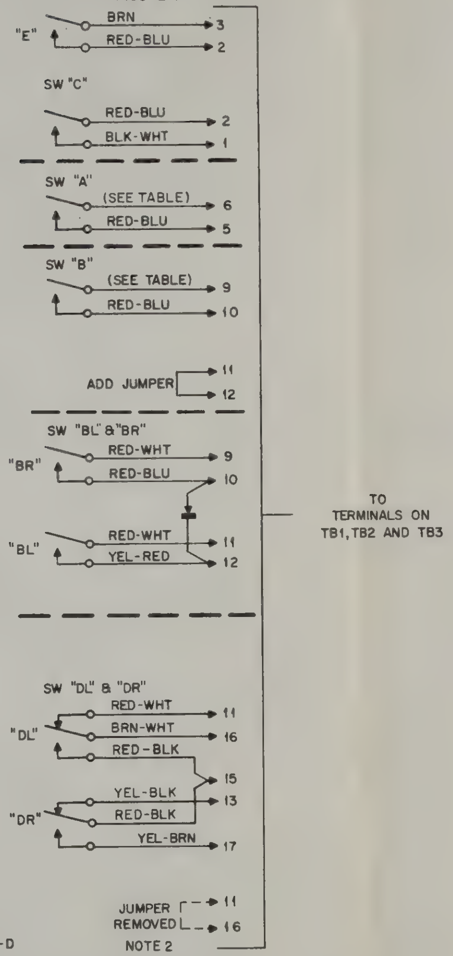

"C"
"BL"
"B"
"BR"
"A"
1 2 3 4 5 6
7 8 9 10 11 12
13 14 15 16 17 18
TB1
TB2
TB3

FIGURE 3
BACK VIEW

SWITCH SCHEMATICS

FIGURE 1


"E"
BRN
3
RED-BLU
2
SW "C"
RED-BLU
2
BLK-WHT
1
SW "A"
(SEE TABLE)
6
RED-BLU
5
SW "B"
(SEE TABLE)
9
RED-BLU
10
ADD JUMPER
11
12
SW "BL" & "BR"
"BR"
RED-WHT
9
RED-BLU
10
"BL"
RED-WHT
11
YEL-RED
12
TO
TERMINALS ON
TB1, TB2 AND TB3
SW "DL" & "DR"
"DL"
RED-WHT
11
BRN-WHT
16
RED-BLK
15
"DR"
YEL-BLK
13
RED-BLK
YEL-BRN
17
JUMPER
REMOVED
11
16
NOTE 2

CEPD-11160-D

AUXILIARY FUNCTION SWITCH KIT WIRING AND LOCATION TABLE

KIT MODEL	SWITCH MODEL	CONNECTS		SWITCH	
		This Color Wire	To This Terminal	POSITION	FUNCTION
CLN1005AA	CLN6075A	Red-Blu	5	A	ON-CRANE-OFF
		Wht-Blk	6		
CLN1006AA	CLN6076A	Red-Blu	5	A	ON-LIGHTS-OFF
		Wht-Blk	6		
CLN1007AA	CLN6077A	Red-Blu	5	A	BRAKE
		Blk-Wht	6		
CLN1007AB	CLN6170A	Wht-Blk	9	BR	BRAKE
		Red-Blu	10		
		#24 solid Jumper	11 12		
CLN1007AC	CLN6077A	Blk-Wht	1	C	BRAKE
		Red-Blu	2		
CLN1008AA	CLN6078A	Red-Blu	5	A	OPERATOR REL
		Blk-Wht	6		
CLN1008AB	CLN6078A	Blk-Wht	9	B	OPERATOR REL
		Red-Blu	10		
		#24 solid Jumper	11 12		
CLN1009AB	CLN6079A	Red-Wht	9	BR	HOOK RT
		Red-Blu	10		
		Red-Wht	11	BL	HOOK LT
		Yel-Red	12		
		Diode	10 12		
CLN1010AA	CLN6080A	Red-Blu	5	A	ON-HOLD-OFF
		Blk-Wht	6		
CLN1011AD	CLN6081A	Remove Jumper from 11 to 16			
		Red-Blk	15	DL	MAG
		Brn-Wht	16		
		Red-Wht	11		
		Yel-Blk	13	DR	MAG OFF
		Red-Blk	15		
		Yel-Brn	17		
CLN1012AD	CLN6085A	Remove Jumper from 11 to 16			
		Red-Blk	15	DL	GRIP
		Brn-Wht	16		
		Red-Wht	11		
		Yel-Blk	13	DR	GRIP OFF
		Red-Blk	15		
		Yel-Brn	17		
CLN1013AE	CLN6172A	Label Only		E	ALARM
CLN1014AA	CLN6086A	Connects to address socket on battery shield		A	CRANE SELECT (2)
CLN1014AC	CLN6086A			C	CRANE SELECT (2)
CLN1015AA	CLN6087A			A	CRANE SELECT (3)
CLN1015AC	CLN6087A			C	CRANE SELECT (3)
CLN1017AE	CLN6173A	Label Only		E	ALARM/RESET
CLN1018AE	CLN6174A	Label Only		E	RESET

NOTES:

1. THE ABOVE TABLE GIVES THE WIRING AND LOCATIONS FOR EACH AUXILIARY FUNCTION SWITCH KIT. THE WIRE COLORS REFER TO THE WIRES ON THE SWITCHES SUPPLIED AS PART OF THE KIT MODELS CALLED OUT. THE LOCATIONS OF THE NUMBERED TERMINALS ARE SHOWN IN FIGURE 1. THE SWITCH POSITIONS ARE SHOWN IN FIGURES 2 AND 3.
2. THIS JUMPER REMOVED WHEN SWITCH "DL" AND "DR" IS USED.

EPD-11159-D

Auxiliary Function Switch Kits
Location and Wiring Detail
Motorola No. CEPD-11160-D
8/28/68-RS

NOTES:

1. UNLESS OTHERWISE SPECIFIED:
   ALL CAPACITOR VALUES ARE IN MICROFARADS.
   ALL RESISTOR VALUES ARE IN OHMS; K = 1000 OHMS
2. ALL VOLTAGE READINGS ARE REFERENCED TO THE POSITIVE SIDE OF THE BATTERY (+).
3. WHEN USED, TUNING RESISTORS A THROUGH AG ARE FACTORY SELECTED.
4. PLUG IS SHOWN WIRED FOR SELECTED CRANE ADDRESS "TSM" AS AN EXAMPLE ONLY.
5. WIRE IS JUMPERED TO -14 V DC IN THREE-MOTOR SWITCH MODELS.
6. IN FOUR- AND FIVE-MOTOR MODELS ONLY.
7. SWITCH LABELS DEPEND ON APPLICATION.
8. JUMPER JU1 REMOVED AND SWITCH S8 ADDED IN FIVE-MOTOR MODELS.
9. WHEN THE MOTOR CONTROL SWITCHES ARE IN THE NEUTRAL POSITION, A REST FREQUENCY, TONE U, IS GENERATED IN THE HIGH MFO AND 1400 CPS IS GENERATED IN THE LOW MFO.
10. MOTOR SWITCHES S3 AND S5 USE RIGHT SIDE OF SWITCH. MOTOR SWITCHES S4 AND S6 USE LEFT SIDE OF SWITCH.

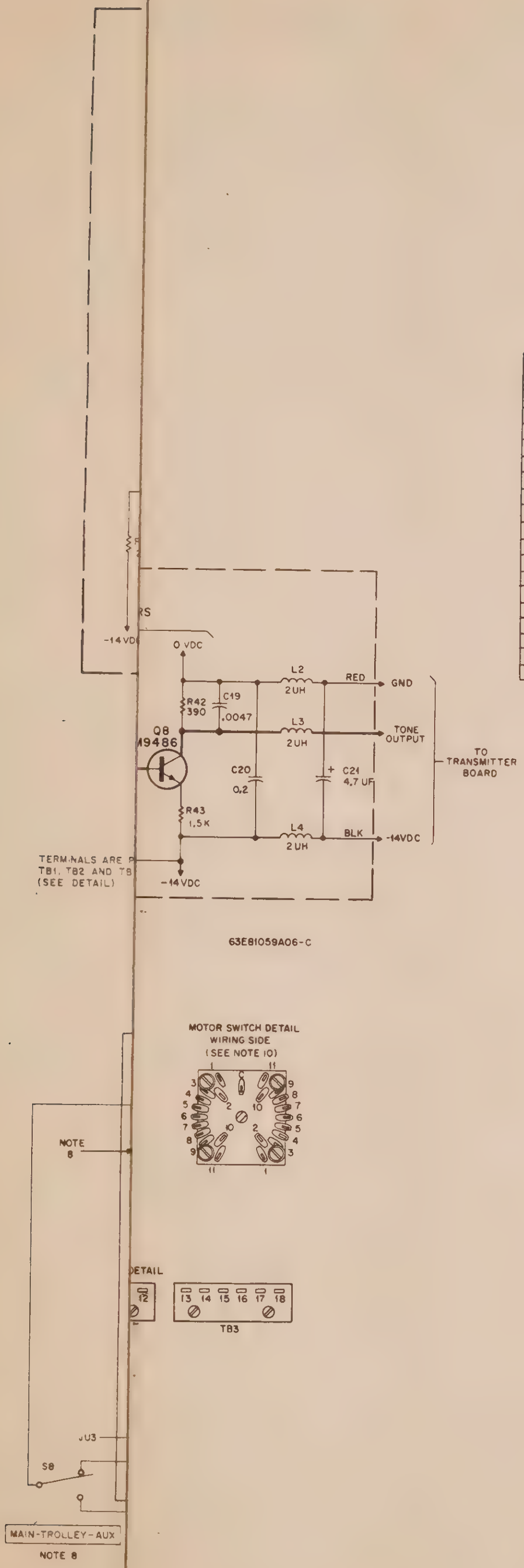
TONE CHART

CODE	FREQUENCY IN CPS	GROUP
A	490	LOW FREQ. TONES
B	620	
C	750	
D	880	
E	1010	
F	1140	
G	1270	
H	1530	HIGH FREQ. TONES
J	1660	
K	1790	
L	1920	
M	2050	
N	2180	
P	2310	
R	2440	
S	2570	
T	2700	
U	2830	

MODEL TABLE

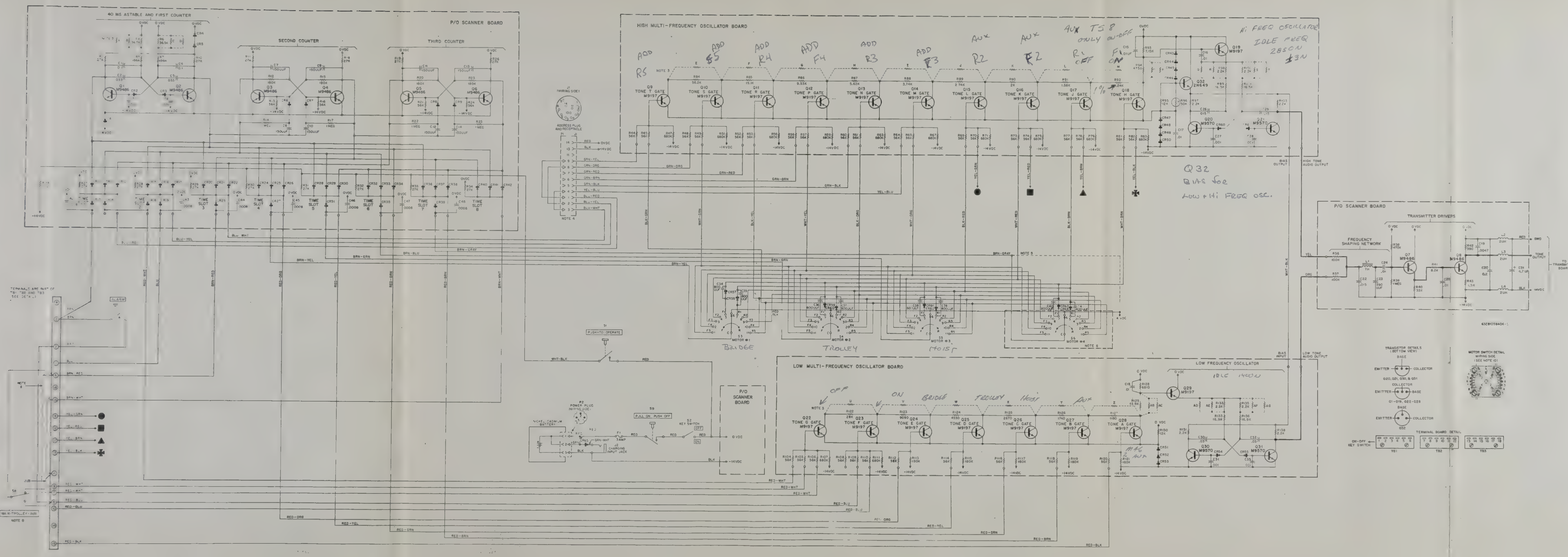
MODEL	SUFFIX	DESCRIPTION
CLN6160A		SCANNER BOARD
CLN6215A		LOW MULTI-FREQ. OSC. BOARD
CLN6216A		HIGH MULTI-FREQ. OSC. BOARD
CLN6161A		PANEL & HDWE. KIT
CLN6137A	1	SWITCH KIT (3 MOTOR)
CLN6138A	1	SWITCH KIT (4 MOTOR)

EPD-21895-O


RS
-14 VDC
0 VDC
L2
2UH
RED
GND
R42
390
C19
.0047
Q8
49486
L3
2UH
TONE OUTPUT
TO TRANSMITTER BOARD
C20
0.2
C21
4.7 UF
R43
1.5K
L4
2UH
BLK
-14VDC
TERMINALS ARE P
TB1, TB2 AND TB
(SEE DETAIL)
-14VDC
63E81059A06-C
MOTOR SWITCH DETAIL
WIRING SIDE
(SEE NOTE 10)
NOTE 8
DETAIL
12
13 14 15 16 17 18
TB3
JU3
S8
MAIN-TROLLEY-AUX
NOTE 8

PREVIOUS REVISIONS AND PARTS LIST SHOWN ON BACK OF THIS DIAGRAM.

Control Transmitter and
Encoder Unit Schematic Diagram
Motorola No. 63E81059A06-C
1/8/70-RS

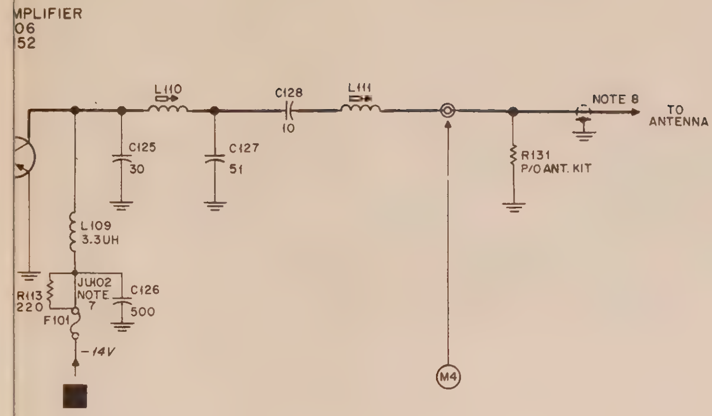

40 MS ASTABLE AND FIRST COUNTER
SECOND COUNTER
THIRD COUNTER
P/O SCANNER BOARD
TIME SLOT
ADDRESS PLUG AND RECEPTACLE
HIGH MULTI-FREQUENCY OSCILLATOR BOARD
ADD R5
ADD S5
ADD R4
ADD F4
ADD R3
ADD F3
AUX R2
AUX F2
R1 OFF
F1 ON
AUX TS 8 ONLY ON-OFF
1%
Hi FREQ OSCILLATOR IDLE FREQ 2850N ±3N
NOTE 3
TONE T GATE
TONE S GATE
TONE R GATE
TONE P GATE
TONE N GATE
TONE M GATE
TONE L GATE
TONE K GATE
TONE J GATE
TONE H GATE
M9197
2N649
M9570
BIAS OUTPUT
HIGH TONE AUDIO OUTPUT
Q32 BIAS for LOW + Hi FREQ OSC.
MOTOR #1
MOTOR #2
MOTOR #3
MOTOR #4
NOTE 6
BRIDGE
TROLLEY
HOIST
PUSH-TO-OPERATE
POWER PLUG
FULL ON, PUSH OFF
KEY SWITCH
CHARGING INPUT JACK
BATTERY
P/O SCANNER BOARD
LOW MULTI-FREQUENCY OSCILLATOR BOARD
OFF
ON
BRIDGE
TROLLEY
HOIST
AUX
TONE G GATE
TONE F GATE
TONE E GATE
TONE D GATE
TONE C GATE
TONE B GATE
TONE A GATE
M46 2 AUX
LOW FREQUENCY OSCILLATOR
IDLE 1400N
BIAS INPUT
LOW TONE AUDIO OUTPUT
TRANSMITTER DRIVERS
FREQUENCY SHAPING NETWORK
TO TRANSMITTER BOARD
TONE OUTPUT
63E81059A06-
TRANSISTOR DETAILS (BOTTOM VIEW)
EMITTER
COLLECTOR
BASE
MOTOR SWITCH DETAIL
TERMINAL BOARD DETAIL
ON-OFF KEY SWITCH
TB1
TB2
TB3
NOTE 8

NOTES:

1. UNLESS OTHERWISE SPECIFIED:
   ALL CAPACITOR VALUES ARE IN MICROFARA
   ALL RESISTOR VALUES ARE IN OHMS. K = 1

PREVIOUS REVISIONS AND PARTS LIST
SHOWN ON BACK OF THIS DIAGRAM.

Control Transmitter and
Encoder Unit Schematic Diagram
Motorola No. 63E81059A06-C
1/8/70-RS


MPLIFIER
06
52
L110
C128
10
L111
NOTE 8
TO ANTENNA
C125
30
C127
51
R131
P/O ANT. KIT
L109
3.3UH
JU102
NOTE
7
C126
500
R113
220
F101
-14V
M4

LATED

C.
TER.

DL OUTPUT IS
EMOVED FROM

REAS OF HIGH

ADJUSTED

TION
NSMITTER
R CRYSTAL

PD-11201-C

PREVIOUS REVISIONS AND PARTS LIST
SHOWN ON BACK OF THIS DIAGRAM

NTC6010AA 72-76 MC Transmitter
Schematic Diagram and Circuit Board Detail
Motorola No. EPD-11157-F
1/8/70-RS

REVISIONS

DIAG. ISSUE	CHASSIS AND SUFFIX NO.	REF. SYMBOL	CHANGE	LOCATION	REFER TO CIRCUIT BOARD
A	CLN6215A-1		ADDED ALTERNATE RESISTORS	PARTS LIST	EPD-21839-A
	CLN6216A-1				EPD-21841-A
B	CLN6215A-2	R129	WAS 6D82527F02, 1240 ±1%; 1/2 w or 6D82672B20. 1.24 K ±1%; 1/4 w	Q29 BASE	EPD-21839-B
C	CLN6216A-2	R94	WAS 6D82527F03, 4320; 1/2 w or 6D82672B29. 4320; 1/4 w	Q18 COLLECTOR	EPD-21841-B

PARTS LIST

CLN6114A Address Plug EPD-12078-O

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
P1	CLN6114A	consists of a 9 cont. male plug containing an internal jumpering arrangement NOTE: When ordering a replacement plug, specify CLN6114A Address Plug and mention the code letters stamped on the plug.

CLN6124A Transfer Switch Kit (Motor) EPD-12079-O

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
		SWITCH, toggle:
S8	40A80248	spdt

CLN6097A Ni-Cad Battery Kit EPD-12080-O

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
	NON-REFERENCED ITEMS	
	60D82447G01	BATTERY, nickel cadmium, 14 v

CLN6161A Panel & Hardware Kit EPD-17821-O

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
		SEMICONDUCTOR DEVICE, diode: (SEE NOTE)
CR65	48C82095C01	silicon
		FUSE:
F1	65R20404	3 amp; 250 v
		CONNECTOR, receptacle:
J1	9C857358	female; 12 cont
		JACK, phone:
J2	9C82684D01	2 cond. does not incl. 15A82688D01 COVER
		CONNECTOR, plug:
P2	28A16313	male; 3 cont. does not incl. 15K801256 SHELL
		SWITCH
S2	40B82256G01	lock: spst
S9	40B82081F01	push-pull: spst
	NON-REFERENCED ITEMS	
	15C83590B01	COVER, bottom
	15C83589B01	COVER, rear
	55B83055C01	LATCH

CHN6006A Housing Kit (3 & 4 Motor W/Alarm)
CHN6007A Housing Kit (3 & 4 Motor Wo/Alarm) EPD-12077-O

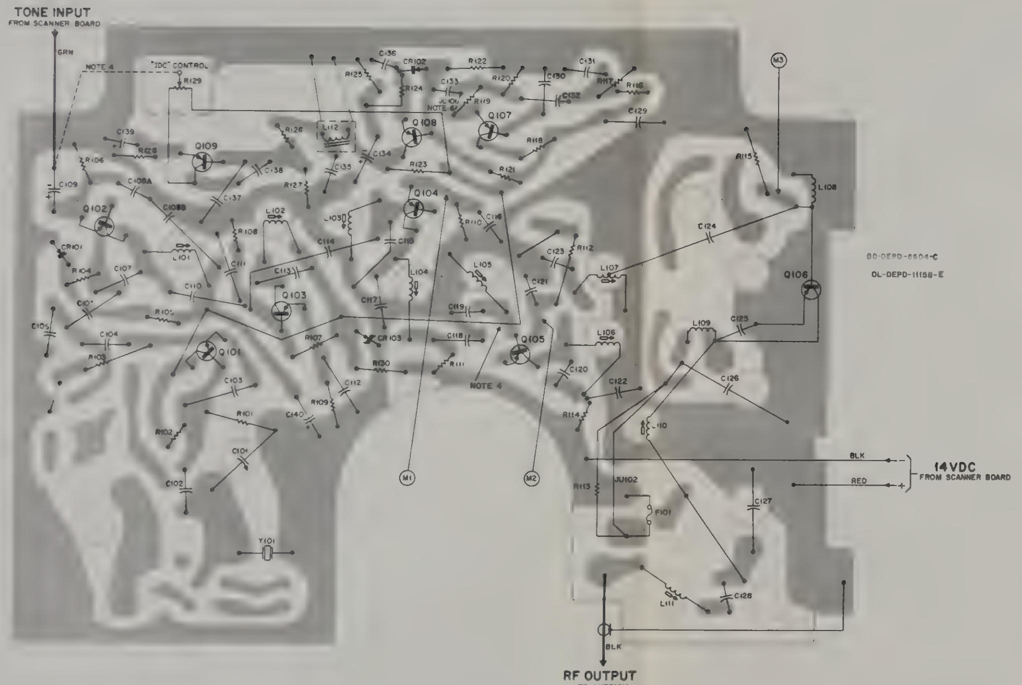
REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
		SWITCH:
S1, 7	40C83559B01	spst
	NON-REFERENCED ITEMS	
	1V80751A72	ACTUATOR: assy. (Wo/Alarm)
	1V80751A70	ACTUATOR: assy. (W /Alarm)
	38B83560B01	BUTTON

CLN6137A Switch Kit (3 Motor)
CLN6138A Switch Kit (4 Motor) EPD-12076-A

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
		CAPACITOR, fixed:
C34 thru 41	21K847070	800 uuf ±10%; 600 v
		SEMICONDUCTOR DEVICE, diode: SEE NOTE
CR57 thru 64	48C82392B03	silicon
		SWITCH:
S3, 4, 5, 6	40C83782C01	rotary; single pole, 11 pos.
		BOARD, terminal:
TB1, 2, 3	31A849459	6 solder lug
	NON-REFERENCED ITEMS	
	36C83601B04	LEVER, switch (BRIDGE) p/o S3
	36C83601B02	LEVER, switch (TROLLEY) p/o S4
	36C83601B03	LEVER, switch (HOIST); p/o S5
	36C83601B01	LEVER, switch (AUX HOIST); p/o S6

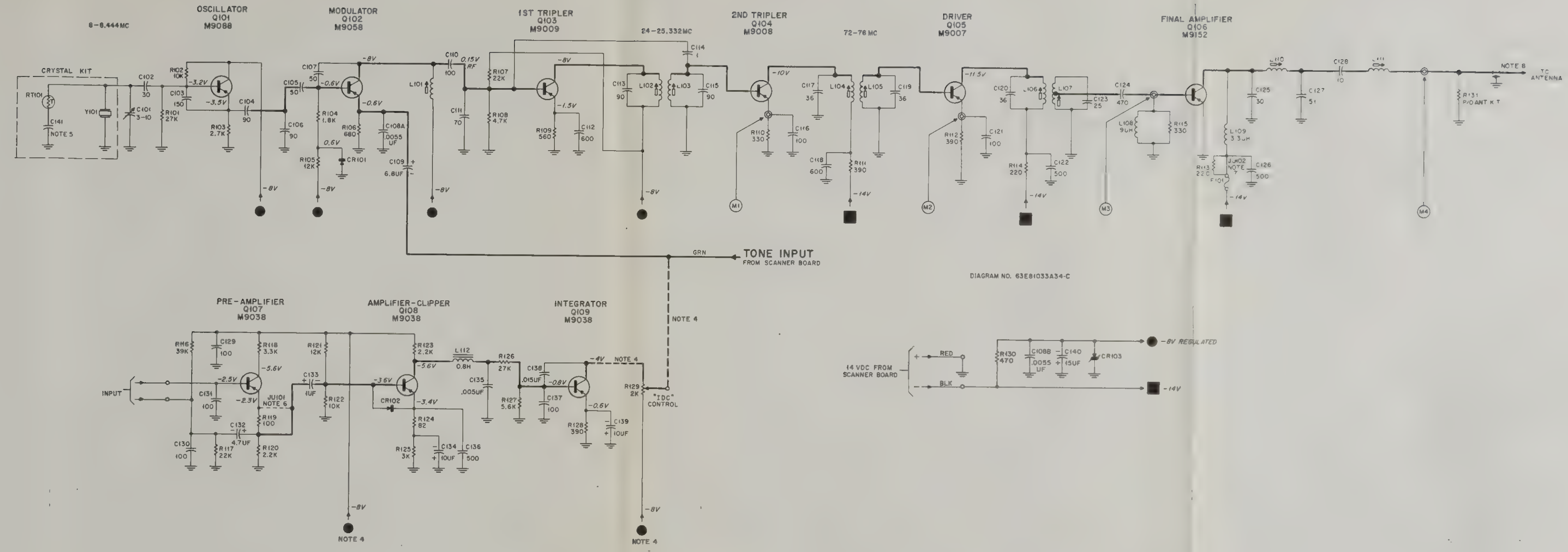
NOTE:

Replacement diodes must be ordered by Motorola part number only for optimum performance.


TONE INPUT
FROM SCANNER BOARD
GRN
NOTE 4
"IDC" CONTROL
R129
Q101
Q102
Q103
Q104
Q105
Q106
Q107
Q108
Q109
L112
Y101
M1
M2
M3
NOTE 4
L108
L107
C124
JU102
F101
L111
C128
BLK
RED
14VDC
FROM SCANNER BOARD
BLK
RF OUTPUT
TO ANTENNA

PLATING SIDE

8D-DEPD-6604-C
OL-DEPD-11158-E


8-8.444MC
OSCILLATOR
Q101
M9088
MODULATOR
Q102
M9058
1ST TRIPLER
Q103
M9009
24-25.332MC
2ND TRIPLER
Q104
M9008
72-76 MC
DRIVER
Q105
M9007
FINAL AMPLIFIER
Q106
M9152
CRYSTAL KIT
RT101
C141
NOTE 5
Y101
C101
3-10
C102
30
R101
27K
R102
10K
C103
150
-3.2V
-3.5V
R103
2.7K
C104
90
C105
50
C107
50
-0.6V
-8V
R104
1.8K
R105
12K
0.6V
CR101
R106
680
C108A
.0055
UF
C109
6.8UF
C106
90
L101
C110
100
0.15V
RF
C111
70
R107
22K
R108
4.7K
-1.5V
R109
560
C112
600
C113
90
L102
L103
C115
90
C114
1
-10V
R110
330
C116
100
C117
36
L104
C118
600
R111
390
-14V
L105
C119
36
-11.5V
R112
390
C121
100
C120
36
L106
R114
220
C122
500
L107
C123
25
C124
470
L108
9UH
R115
330
L109
3.3UH
R113
220
JU102
NOTE 7
F101
C126
500
C125
30
L110
C127
51
C128
10
L111
R131
P/O ANT KIT
NOTE 8
TO ANTENNA
M1
M2
M3
M4
GRN
TONE INPUT
FROM SCANNER BOARD
NOTE 4
PRE-AMPLIFIER
Q107
M9038
AMPLIFIER-CLIPPER
Q108
M9038
INTEGRATOR
Q109
M9038
INPUT
R116
39K
C129
100
R118
3.3K
-5.6V
-2.5V
-2.3V
C131
100
JU101
NOTE 6
R119
100
C132
4.7UF
C130
100
R117
22K
R120
2.2K
R121
12K
C133
1UF
R122
10K
-8V
NOTE 4
R123
2.2K
-5.6V
-3.6V
CR102
-3.4V
R124
82
R125
3K
C134
10UF
C136
500
L112
0.8H
C135
.005UF
R126
27K
R127
5.6K
C138
.015UF
-0.8V
C137
100
-4V
NOTE 4
-0.6V
R128
390
C139
10UF
R129
2K
"IDC"
CONTROL
-8V
NOTE 4
DIAGRAM NO. 63E81033A34-C
14 VDC FROM
SCANNER BOARD
RED
BLK
R130
470
C108B
.0055
UF
C140
15UF
CR103
-8V REGULATED
-14V

NOTES.

1. UNLESS OTHERWISE SPECIFIED:
   RESISTOR VALUES ARE IN OHMS; K=1000
   CAPACITOR VALUES ARE IN MICROMICROFARADS.
2. ALL VOLTAGE READINGS ARE REFERENCED TO +14 VDC
   DC READINGS TAKEN WITH A MOTOROLA DC MULTIMETER
3. FREQUENCY CALCULATION:

   $f_o = \frac{f_c}{9}$

4. FOR TONE ONLY APPLICATIONS, THE "I. D. C." CONTROL OUTPUT IS DISCONNECTED AND THE 8 VOLT SUPPLY JUMPER IS REMOVED FROM THE CIRCUIT BOARD.
5. THE VALUE OF C141 IS FACTORY SELECTED.
6. JUMPER JU101 MAY BE REMOVED FOR OPERATION IN AREAS OF HIGH BACKGROUND NOISE (AUDIO ONLY).
7. JU102 REMOVED FOR 100-MILLIWATT OPERATION.
8. ANTENNA TRIMMER CAPACITOR ON ANTENNA MUST BE ADJUSTED FOR MAXIMUM FIELD STRENGTH.

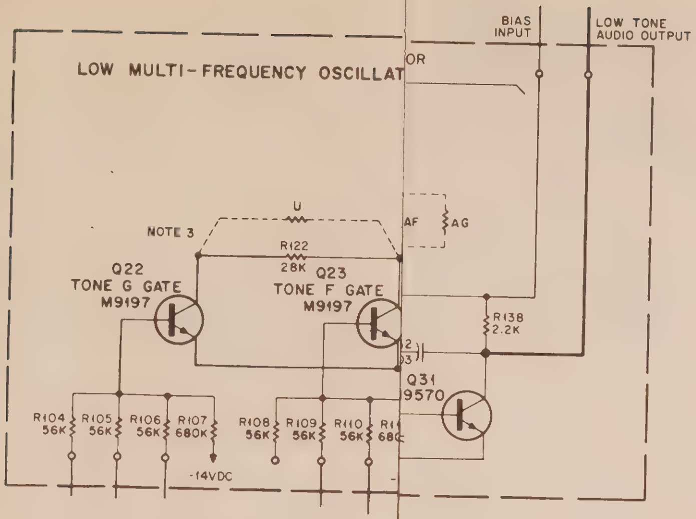
MODEL TABLE

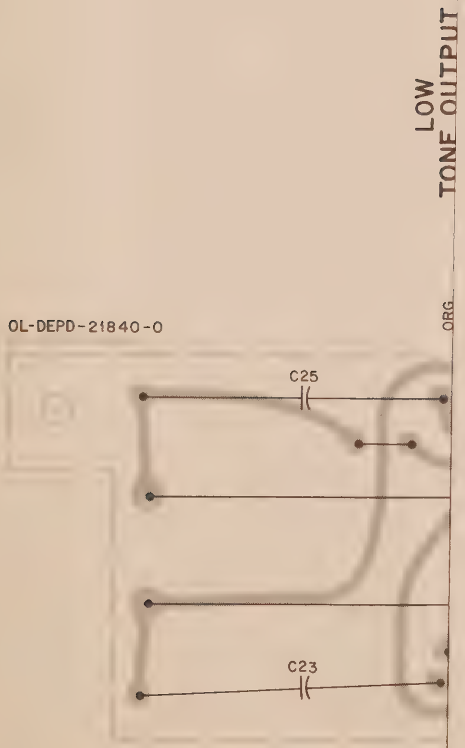
MODEL	SUFFIX	DESCRIPTION
NTC6010AA	1	72-76 MC TRANSMITTER
NLC6000A		TRANSMITTER CRYSTAL KIT

EPD-11201-C

PREVIOUS REVISIONS AND PARTS LIST
SHOWN ON BACK OF THIS DIAGRAM

NTC6010AA 72-76 MC Transmitter
Schematic Diagram and Circuit Board Detail
Motorola No. EPD-11157-F
1/8/70-RS


BIAS INPUT
LOW TONE AUDIO OUTPUT
LOW MULTI-FREQUENCY OSCILLATOR
NOTE 3
U
AF
AG
R122
28K
Q22
TONE G GATE
M9197
Q23
TONE F GATE
M9197
R138
2.2K
Q31
9570
R104 56K
R105 56K
R106 56K
R107 680K
-14VDC
R108 56K
R109 56K
R110 56K
68


LOW
TONE OUTPUT
ORG
OL-DEPD-21840-0
C25
C23

VOLTAGE READINGS

TRANSISTOR	BASE	EMITTER	COLLECTOR
Q22	-12.7	-12.9	-12.7
Q23	-13.2	-12.9	- 9.5
Q24	-13.0	-12.9	- 8.5
Q25	-13.0	-12.9	- 7.6
Q26	-13.0	-12.9	- 6.8
Q27	-13.0	-12.9	- 6.0
Q28	-13.8	-12.9	- 5.2
Q29	- 4.4	- 5.0	0
Q30	-13.5	-14.0	- 8.7
Q31	-13.5	-14.0	- 8.3

NOTES:

1. ALL VOLTAGE READINGS ARE DC AND REFERENCED WITH RESPECT TO +14 VDC.
2. SOME VOLTAGES WILL BE PULSATING. IN SUCH CASES THE VOLTAGE READING GIVEN IS AN AVERAGE VALUE.

EPD-12358-O

PREVIOUS REVISIONS AND PARTS LIST
SHOWN ON BACK OF THIS DIAGRAM

CLN6215A Low Multiple Frequency
Oscillator Circuit Board Detail
Motorola No. EPD-21839-B
1/8/70-RS

REVISIONS

DIAG. ISSUE	CHASSIS AND SUFFIX NO.	REF. SYMBOL	CHANGE	LOCATION	REFER TO CIRCUIT BOARD
A	NTC6010AA	C105, 107	WERE 21K864013, 50 uuf	Q102 BASE	XMTR CIRCUIT BD
		C106	WAS 21K861434, 40 uuf		
B	NTC6010AA-1	C105, 106	INTERCHANGED VALUES.	Q102 BASE	
C	NLC6000A		REPLACES MODEL NLD6200A XMTR. XTAL KIT	PARTS LIST	NONE
D	CAC6000A-1	R131	ADDED	RF OUTPUT CIRCUIT BD.	
F	CAC6000A-1		ADDED PLATING SIDE DESIGNATION		
F	NTC6010A-1	C127	WAS 20C82349D07, 15-60 uuf	Q106 COLLECTOR	XMTR CIRCUIT BD
		R130	WAS 6K129775, 330	BELOW Q105 CIRCUITRY	NONE

PARTS LIST

NTC6010AA Xmtr. Bd. (72-76 MC) EPD-12156-D

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
		CAPACITOR, fixed: uuf ±10%; 75 v; unl stated
C101	20C82399D08	var; 3-10; +2 to 4.5% @ -55°C, +2 to 2.5% @ 85°C; NP0; 200 v; coded GRY
C102	21D82877B06	30; N150
C103	21D82877B34	150; NP0; 50 v
C104, 106, 113, 115	21D82877B33	90; NP0; 50 v
C105; 107	21D82877B31	50; NP0
C108	21C82724H01	consists of 2 sect:
C108A		.0055 uf +100 to -20% @ 1KC @25°C
C108B		.0055 uf +100 to -20% @ 1KC @25°C
C109	23C82397D09	6.8 uf +40-20%; 15 v
C110	21K861436	100; N750
C111	21K861435	70; N150
C112, 118	21K851299	600; 600 v
C114	21C82450B28	1; 500 v
C116, 121, 129, 130, 131, 137	21K861437	100; N2200
C117, 119, 120	21K861433	36; N150
C122, 126, 136	21K847065	500 GMV; 250 v
C123	21K865197	25; N150
C124	21D82537B06	470 ±5%; 300 v
C125	21D82610C14	30 ±5%; N150; 200 v
C127	21D82355B13	51 ±5%; N1500
C128	21K861430	10; N150
C132	23C82397D05	4.7 uf +40-20%; 3 v
C133	23C82397D07	1 uf +40-20%; 15 v
C134, 139	23C82397D03	10 uf ±20%; 6 v
C135	8C82548E03	.005 uf; 100 v
C138	8C82548E02	.015 uf; 100 v
C140	23C82397D17	15 uf ±20%; 20 v (factory selected)
		SEMICONDUCTOR DEVICE, diode: (SEE NOTE I)
CR101	48C82392B03	silicon
CR102	48C82178A01	germanium
CR103	48C82256C08	zener
		FUSE, cartridge:
F101	65B82896B01	100 ma; 125 v; min.
		COIL, RF: unl stated
L101	24C82901B06	BLK; does not incl. 76B82451B02 CORE, tuning
L102, 103	24C82904B13	RED-RED; does not incl. 76K861425 CORE, tuning
L104, 105	24C82904B17	YEL-BLK; does not incl. 76K861425 CORE, tuning
L106	SP395164D	5-1/2 turn; does not incl. 76K861425 CORE, tuning
L107	SP395164C	6 turn; tapped @ 1 turn; does not incl. 76K861425 CORE, tuning
L108	24B847920	choke; 9 uh
L109	SP395164E	choke; 3.3 uh
L110	SP395164B	5 turn; does not incl. 76K861425 CORE, tuning
L111	SP395164A	13 turn; does not incl. 76K861425 CORE, tuning
L112	25B82872B01	choke; audio: 0.8 h
		TRANSISTOR: (SEE NOTE I)
Q101	48R869088	P-N-P; type M9088
Q102	48R869058	P-N-P; type M9058
Q103	48R869009	P-N-P; type M9009
Q104	48R869008	P-N-P; type M9008
Q105	48R869007	P-N-P; type M9007
Q106	48R869152	P-N-P; type M9152
Q107, 108, 109	48R869038	P-N-P; type M9038
		RESISTOR, fixed: ±10%; 1/4 w
R101	6K127806	27K
R102	6K129225	10K
R103	6K128688	2.7K
R104	6K129269	1.8K
R105	6K129887	12K ±5%
R106	6K128599	680
R107, 117	6K128685	22K
R108	6K127804	4.7K
R109	6K129620	560
R110, 115	6K129775	330
R111, 112	6K129863	390
R113, 114	6K127800	220
R116	6K128903	39K
R118	6K129231	3.3K
R119	6K129753	100
R120	6K128689	2.2K
R121	6K129887	12K ±5%
R122	6K129668	10K ±5%
R123	6K129804	2.2K ±5%
R124	6K129224	82
R125	6S124A60	3K ±5%
R126	6K127806	27K
R127	6K129433	5.6K
R128	6K129863	390
R129	18B82876B04	var; 2K
R130	6K127801	470

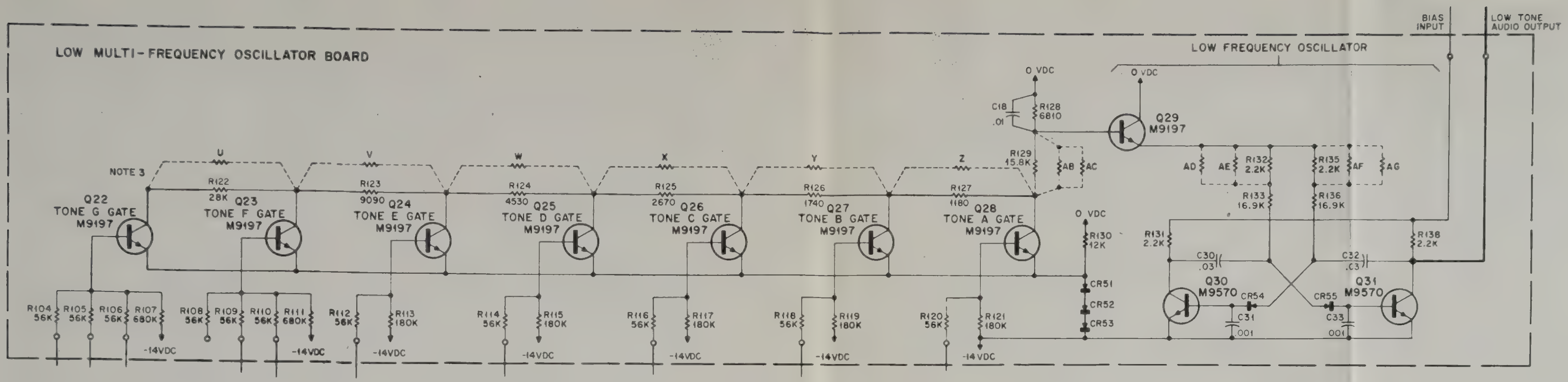
NLC6000A Xmtr. Xtal Kit (.0005%) EPD-17482-O

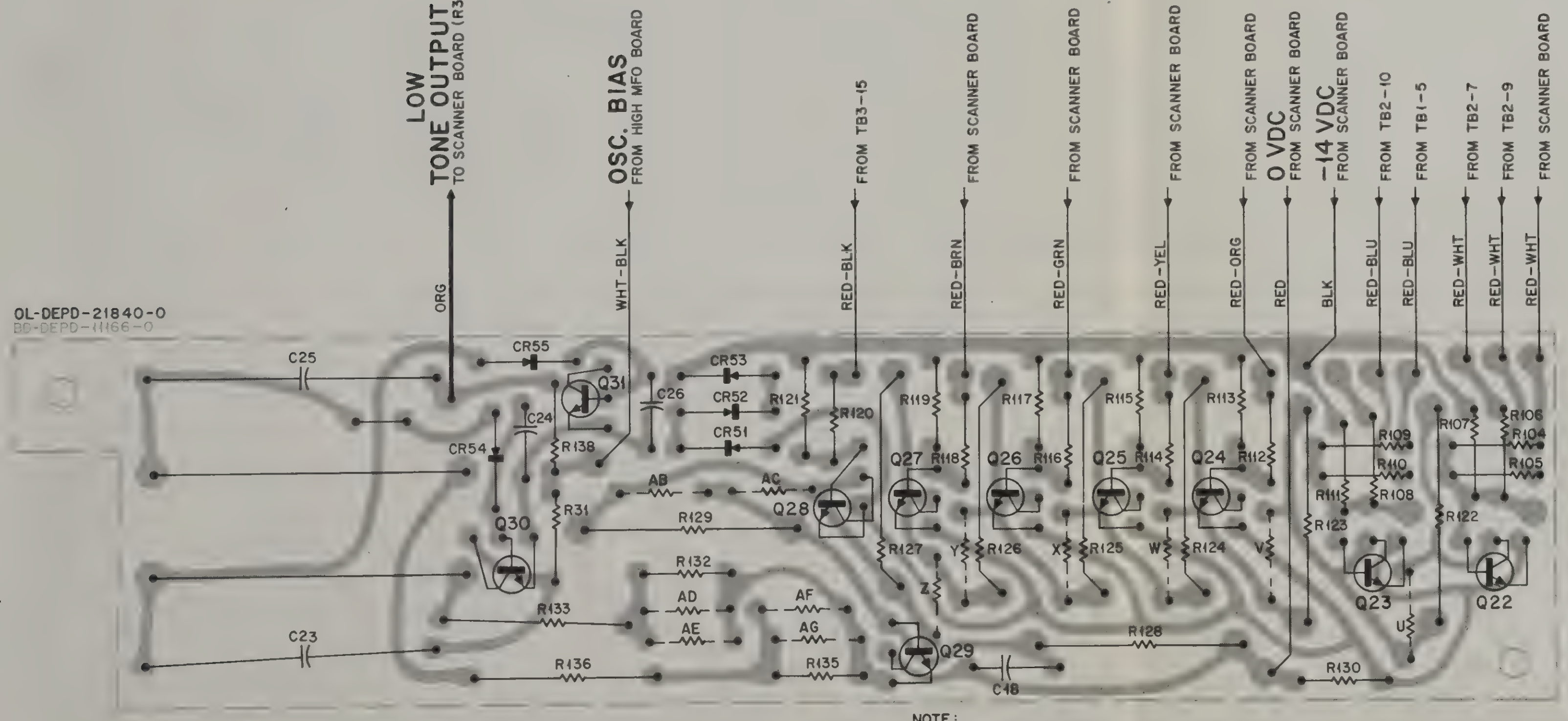
REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
		CAPACITOR, fixed: uuf ±0.25 uuf; NP0; 50 v
C141	21D82358G01 or21D82358G02 or21D82358G03 or21D82358G04	3.3; coded BLK 4.8; coded BRN 5.6; coded ORG 6.2; coded BLU factory selected
		THERMISTOR, disc;
RT101	6B82357G01	100 ohms ±5%; @25°C
		CRYSTAL UNIT, quartz: xmtr. control (SEE NOTE II)
Y101	YVNW-83 or YVNW-83 or YVNW-83 or YVNW-83 or YVNW-83	coded BLK coded BRN coded ORG coded BLU coded PINK
NON-REFERENCED ITEM		
	14A83485A01	INSULATOR, xtal

NOTES:

I Replacement transistors and diodes must be ordered by Motorola part number only for optimum performance.

II Crystals are part of the Control Transmitter Model only. When ordering crystal units specify car. freq.(s), crystal freq.(s), and crystal type number.


LOW MULTI-FREQUENCY OSCILLATOR BOARD
LOW FREQUENCY OSCILLATOR
BIAS INPUT
LOW TONE AUDIO OUTPUT
NOTE 3
U
V
W
X
Y
Z
O VDC
C18 .01
R128 6810
R129 15.8K
Q29 M9197
AB
AC
AD
AE
AF
AG
R132 2.2K
R135 2.2K
R133 16.9K
R136 16.9K
R131 2.2K
R138 2.2K
C30 .03
C32 .03
Q30 M9570
Q31 M9570
CR54
CR55
C31 .001
C33 .001
R130 12K
CR51
CR52
CR53
R122 28K
R123 9090
R124 4530
R125 2670
R126 1740
R127 1180
Q22 TONE G GATE M9197
Q23 TONE F GATE M9197
Q24 TONE E GATE M9197
Q25 TONE D GATE M9197
Q26 TONE C GATE M9197
Q27 TONE B GATE M9197
Q28 TONE A GATE M9197
R104 56K
R105 56K
R106 56K
R107 680K
R108 56K
R109 56K
R110 56K
R111 680K
R112 56K
R113 180K
R114 56K
R115 180K
R116 56K
R117 180K
R118 56K
R119 180K
R120 56K
R121 180K
-14VDC


LOW TONE OUTPUT TO SCANNER BOARD (R36)
OSC. BIAS FROM HIGH MFO BOARD
FROM TB3-15
FROM SCANNER BOARD
FROM SCANNER BOARD
FROM SCANNER BOARD
FROM SCANNER BOARD
0 VDC FROM SCANNER BOARD
-14 VDC FROM SCANNER BOARD
FROM TB2-10
FROM TB1-5
FROM TB2-7
FROM TB2-9
FROM SCANNER BOARD
ORG
WHT-BLK
RED-BLK
RED-BRN
RED-GRN
RED-YEL
RED-ORG
RED
BLK
RED-BLU
RED-BLU
RED-WHT
RED-WHT
RED-WHT
OL-DEPD-21840-0
BD-DEPD-41166-0
C25
C23
C24
C26
CR55
CR54
CR53
CR52
CR51
Q31
Q30
Q29
Q28
Q27
Q26
Q25
Q24
Q23
Q22
R138
R31
R129
R132
R133
R136
R135
R121
R120
R119
R118
R117
R116
R115
R114
R113
R112
R127
R126
R125
R124
R123
R122
R128
R130
R109
R110
R111
R108
R107
R106
R104
R105
AB
AC
AD
AE
AF
AG
U
V
W
X
Y
Z
C18

NOTE:

WHEN USED, THE TUNING RESISTORS (DASHED LINES) ARE FACTORY SELECTED.

PLATING SIDE

VOLTAGE READINGS

TRANSISTOR	BASE	EMITTER	COLLECTOR
Q22	-12.7	-12.9	-12.7
Q23	-13.2	-12.9	- 9.5
Q24	-13.0	-12.9	- 8.5
Q25	-13.0	-12.9	- 7.6
Q26	-13.0	-12.9	- 6.8
Q27	-13.0	-12.9	- 6.0
Q28	-13.8	-12.9	- 5.2
Q29	- 4.4	- 5.0	0
Q30	-13.5	-14.0	- 8.7
Q31	-13.5	-14.0	- 8.3

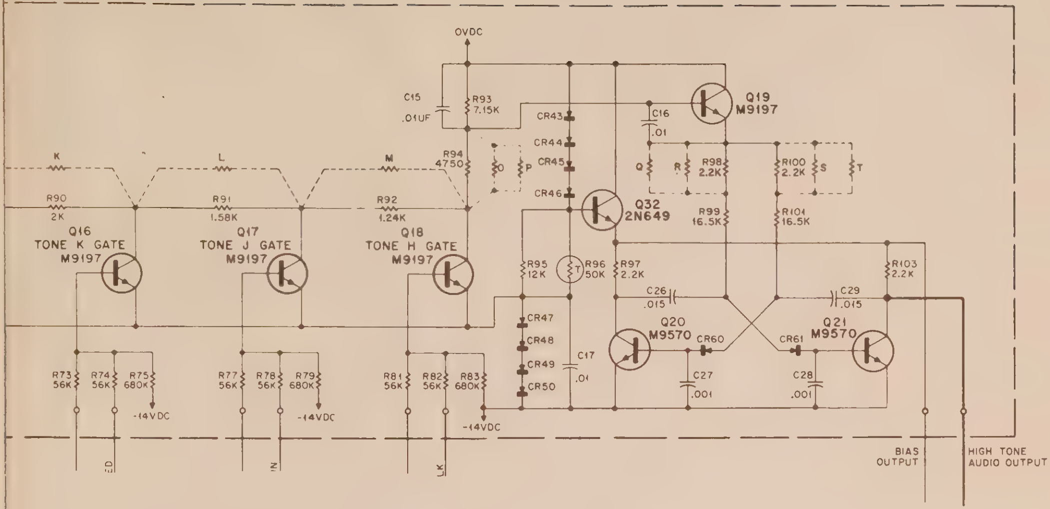
NOTES:

1. ALL VOLTAGE READINGS ARE DC AND REFERENCED WITH RESPECT TO +14 VDC.
2. SOME VOLTAGES WILL BE PULSATING. IN SUCH CASES THE VOLTAGE READING GIVEN IS AN AVERAGE VALUE.

EPD-12358-O

PREVIOUS REVISIONS AND PARTS LIST SHOWN ON BACK OF THIS DIAGRAM

CLN6215A Low Multiple Frequency Oscillator Circuit Board Detail
Motorola No. EPD-21839-B
1/8/70-RS


OVDC
C15
.01UF
R93
7.15K
Q19
M9197
C16
.01
CR43
CR44
CR45
CR46
R94
4750
O
P
Q
R
R98
2.2K
R100
2.2K
S
T
K
L
M
R90
2K
R91
1.58K
R92
1.24K
Q16
TONE K GATE
M9197
Q17
TONE J GATE
M9197
Q18
TONE H GATE
M9197
Q32
2N649
R99
16.5K
R101
16.5K
R95
12K
R96
50K
R97
2.2K
R103
2.2K
C26
.015
C29
.015
Q20
M9570
CR60
CR61
Q21
M9570
CR47
CR48
CR49
CR50
C17
.01
C27
.001
C28
.001
R73
56K
R74
56K
R75
680K
R77
56K
R78
56K
R79
680K
R81
56K
R82
56K
R83
680K
-14VDC
-14VDC
-14VDC
BIAS OUTPUT
HIGH TONE AUDIO OUTPUT

FROM MOTOR SWITCH (R

FROM TB3-

FROM MOTOR SWITCH (F

FROM TB3-

FROM TB2-

VOLTAGE READINGS

TRANSISTOR	BASE	EMITTER	COLLECTOR
Q9	-13.1	-13.1	-6.5
Q10	-13.1	-13.1	-5.7
Q11	-13.1	-13.1	-4.8
Q12	-13.1	-13.1	-4.4
Q13	-13.1	-13.1	-4.1
Q14	-13.1	-13.1	-3.7
Q15	-13.1	-13.1	-3.4
Q16	-13.1	-13.1	-3.2
Q17	-13.1	-13.1	-2.9
Q18	-13.1	-13.1	-2.6
Q19	- 1.6	- 2.2	0
Q20	-13.5	-14.0	-9.0
Q21	-13.5	-14.0	-8.6
Q32	- 1.1	- 1.3	0

NOTES:

1. ALL VOLTAGE READINGS ARE DC AND REFERENCED WITH RESPECT TO +14 V DC.
2. SOME VOLTAGES WILL BE PULSATING. IN SUCH CASES THE VOLTAGE READING GIVEN IS AN AVERAGE VALUE.

EPD-21893-O

PREVIOUS REVISIONS AND PARTS LIST SHOWN ON BACK OF THIS DIAGRAM

CLN6216A High Multiple Frequency
Oscillator Circuit Board Detail
Motorola No. EPD-21841-B
1/8/70-RS

REVISIONS

DIAG. ISSUE	CHASSIS AND SUFFIX NO.	REF. SYMBOL	CHANGE	LOCATION
A	CLN6215A-1	1	ADDED ALTERNATE RESISTORS	PARTS LIST
B	CLN6215A-2	R129	WAS 6D82527F02 OR 6D82672B20	Q29 BASE

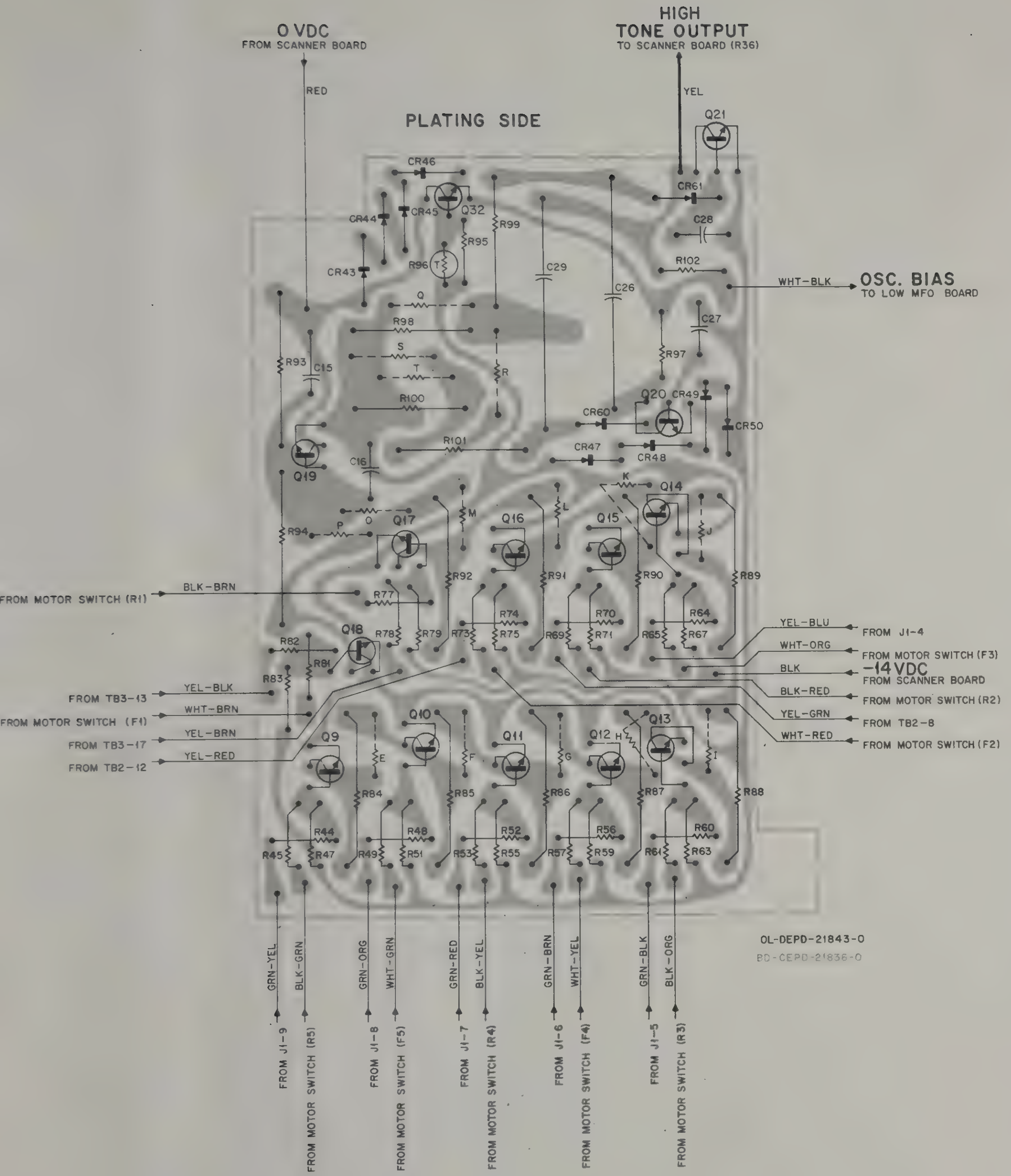
PARTS LIST

CLN6215A Multi-Freq. Osc. (Low) EPD-21907-B

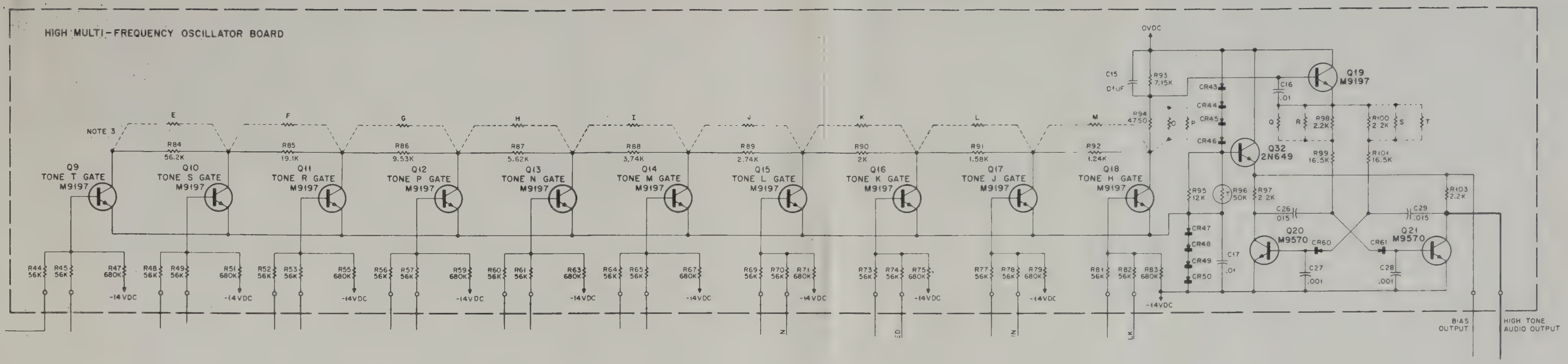
REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
		CAPACITOR, fixed:
C18	21K832501	.01 uf +60-40%; 250 v
C30, 32	8D83445B19	.03 uf ±5%; 50 v
C31, 33	21D82537B16	.001 uf ±5%; 100 v
		SEMICONDUCTOR DEVICE, diode: (SEE NOTE)
CR51, 52, 53, 54	48C864459	germanium
CR55	48C82392B11	silicon
		TRANSISTOR: (SEE NOTE)
Q22 thru 29	48R869197	N-P-N; type M9197
Q30, 31	48R869570	N-P-N; type M9570
		RESISTOR, fixed: ±5%; 1/4 w; unl stated
R104, 105, 106, 108, 109, 110, 112, 114, 116, 118, 120	6S128684	56K
R107, 111	6S131857	680K
R113, 115, 117, 119, 121	6S124B04	180K
R122	6D82527F17	28K ±1%; 1/2 w
	or6D82672B14	28K ±1%
R123	6D82527F14	9090 ±1%; 1/2 w
	or6D82672B15	9.09K ±1%
R124	6D82527F10	4530 ±1%; 1/2 w
	or6D82672B16	4.53K ±1%
R125	6D82527F06	2670 ±1%; 1/2 w
	or6D82672B17	2.67K ±1%
R126	6D82527F04	1740 ±1%; 1/2 w
	or6D82672B18	1.74K ±1%
R127	6D82527F01	1180 ±1%; 1/2 w
	or6D82672B19	1.18K ±1%
R128	6D82527F12	6810 ±1%; 1/2 w
	or6D82672B21	6.81K ±1%
R129	6D82527F61	1.58K ±1%; 1/4 w
	or6D82527F03	1.58K ±1%; 1/2 w
R130	6S129887	12K
R131, 132, 135, 138	6D82526F20	2.2K; glass
R133, 136	6D82672B53	16.9K ±1%; 1/8 w

NOTE:

Replacement transistors and diodes must be ordered by Motorola part number only for optimum performance.


O VDC
FROM SCANNER BOARD
RED
HIGH TONE OUTPUT
TO SCANNER BOARD (R36)
YEL
PLATING SIDE
OSC. BIAS
TO LOW MFO BOARD
WHT-BLK
FROM MOTOR SWITCH (R1)
BLK-BRN
FROM TB3-13
YEL-BLK
FROM MOTOR SWITCH (F1)
WHT-BRN
FROM TB3-17
YEL-BRN
FROM TB2-12
YEL-RED
YEL-BLU
FROM J1-4
WHT-ORG
FROM MOTOR SWITCH (F3)
BLK
-14 VDC
FROM SCANNER BOARD
BLK-RED
FROM MOTOR SWITCH (R2)
YEL-GRN
FROM TB2-8
WHT-RED
FROM MOTOR SWITCH (F2)
GRN-YEL
BLK-GRN
GRN-ORG
WHT-GRN
GRN-RED
BLK-YEL
GRN-BRN
WHT-YEL
GRN-BLK
BLK-ORG
FROM J1-9
FROM MOTOR SWITCH (R5)
FROM J1-8
FROM MOTOR SWITCH (F5)
FROM J1-7
FROM MOTOR SWITCH (R4)
FROM J1-6
FROM MOTOR SWITCH (F4)
FROM J1-5
FROM MOTOR SWITCH (R3)
OL-DEPD-21843-0
BD-DEPD-21836-0

NOTE:
WHEN USED, THE TUNING RESISTORS (DASHED LINES) ARE FACTORY SELECTED.


HIGH MULTI-FREQUENCY OSCILLATOR BOARD
NOTE 3
E
F
G
H
I
J
K
L
M
R84 56.2K
R85 19.1K
R86 9.53K
R87 5.62K
R88 3.74K
R89 2.74K
R90 2K
R91 1.58K
R92 1.24K
Q9 TONE T GATE M9197
Q10 TONE S GATE M9197
Q11 TONE R GATE M9197
Q12 TONE P GATE M9197
Q13 TONE N GATE M9197
Q14 TONE M GATE M9197
Q15 TONE L GATE M9197
Q16 TONE K GATE M9197
Q17 TONE J GATE M9197
Q18 TONE H GATE M9197
R44 56K
R45 56K
R47 680K
R48 56K
R49 56K
R51 680K
R52 56K
R53 56K
R55 680K
R56 56K
R57 56K
R59 680K
R60 56K
R61 56K
R63 680K
R64 56K
R65 56K
R67 680K
R69 56K
R70 56K
R71 680K
R73 56K
R74 56K
R75 680K
R77 56K
R78 56K
R79 680K
R81 56K
R82 56K
R83 680K
-14VDC
OVDC
C15 .01UF
R93 7.15K
R94 4750
O
P
CR43
CR44
CR45
CR46
Q19 M9197
C16 .01
Q
R
R98 2.2K
R100 2.2K
S
T
Q32 2N649
R99 16.5K
R101 16.5K
R95 12K
R96 50K
R97 2.2K
R103 2.2K
C26 .015
C29 .015
Q20 M9570
Q21 M9570
CR60
CR61
CR47
CR48
CR49
CR50
C17 .01
C27 .001
C28 .001
BIAS OUTPUT
HIGH TONE AUDIO OUTPUT

VOLTAGE READINGS

TRANSISTOR	BASE	EMITTER	COLLECTOR
Q9	-13.1	-13.1	-6.5
Q10	-13.1	-13.1	-5.7
Q11	-13.1	-13.1	-4.8
Q12	-13.1	-13.1	-4.4
Q13	-13.1	-13.1	-4.1
Q14	-13.1	-13.1	-3.7
Q15	-13.1	-13.1	-3.4
Q16	-13.1	-13.1	-3.2
Q17	-13.1	-13.1	-2.9
Q18	-13.1	-13.1	-2.6
Q19	- 1.6	- 2.2	0
Q20	-13.5	-14.0	-9.0
Q21	-13.5	-14.0	-8.6
Q32	- 1.1	- 1.3	0

NOTES

1. ALL VOLTAGE READINGS ARE DC AND REFERENCED WITH RESPECT TO +14 V DC.
2. SOME VOLTAGES WILL BE PULSATING. IN SUCH CASES THE VOLTAGE READING GIVEN IS AN AVERAGE VALUE.

EPD-21893-O

PREVIOUS REVISIONS AND PARTS LIST SHOWN ON BACK OF THIS DIAGRAM

CLN6216A High Multiple Frequency
Oscillator Circuit Board Detail
Motorola No. EPD-21841-B
1/8/70-RS

PARTS LIST

CLN6160A Scanner Board EPD-17822-O

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
		CAPACITOR, fixed: uf ±5%; 50 v; unl. stated
C1, 4	8D83445B21	0.1
C2, 5	8D82905G08	.033 ±10%; 25 v
	or8D83293B10	.033
C3, 6	21D82537B16	.001; 100 v
C7 thru 14	21K840047	150 uuf; 500 v
C19	21D82428B09	.0047 ±10%; 100 v
C20	21C82372C02	0.2 +80-20%; 25 v
C21	23K865137	4.7 ±20%; 25 v
C22	8C82548E02	.015 ±10%; 100 v
C23	21K859945	390 uuf; 500 v
C24	8C82548E01	.01 ±10%; 100 v
C25	8D82905G01	.01 ±10%; 25 v
C42 thru 48	21B847070	.0008 ±10%; 600 v
		SEMICONDUCTOR DEVICE, diode: (SEE NOTE)
CR1, 4, 5	48K855216	germanium
CR2, 3, 6, 7 thru 42	48C82392B03	silicon
		COIL
L1	25C82190A02	AF: choke; 7 h
L2, 3, 4	24A890687	RF: choke; 2 uh
		TRANSISTOR: (SEE NOTE)
Q1 thru 8	48K869486	N-P-N; type M9486
		RESISTOR, fixed: ±5%; 1/4 w; unl. stated
R1, 10, 11, 18, 19, 26, 27, 28, 29, 30, 31, 32, 33, 34, 138	6S129886	27K
R4, 6	6D82672B31	36.5K ±1%
R5, 7	6D82672B30	196K ±1%
R12, 15, 20, 23	6S124B04	180K
R13, 16, 21, 24	6S128684	56K
R14, 17, 22, 25, 39	6S129189	1 meg
R36, 37	6S124A97	100K
R38	6S129149	470K
R40	6S129526	33K
R41	6S129983	8.2K
R42	6S129863	390 ±10%
R43	6S129681	1.5K

NOTE:

Replacement transistors and diodes must be ordered by Motorola part number only for optimum performance.

CLN6160A Scanner Circuit Board Detail
Motorola No. PEPD-17616-A
8/28/68-RS

REVISIONS

DIAG. ISSUE	CHASSIS AND SUFFIX NO.	REF. SYMBOL	CHANGE	LOCATION
A	CLN6216A		ADDED ALTERNATE RESISTORS	PARTS LIST
B	CLN6216A-2	R94	WAS 6D82527F09 4320; 1/2 W OR 6D82672B29	Q18 COLLECTOR

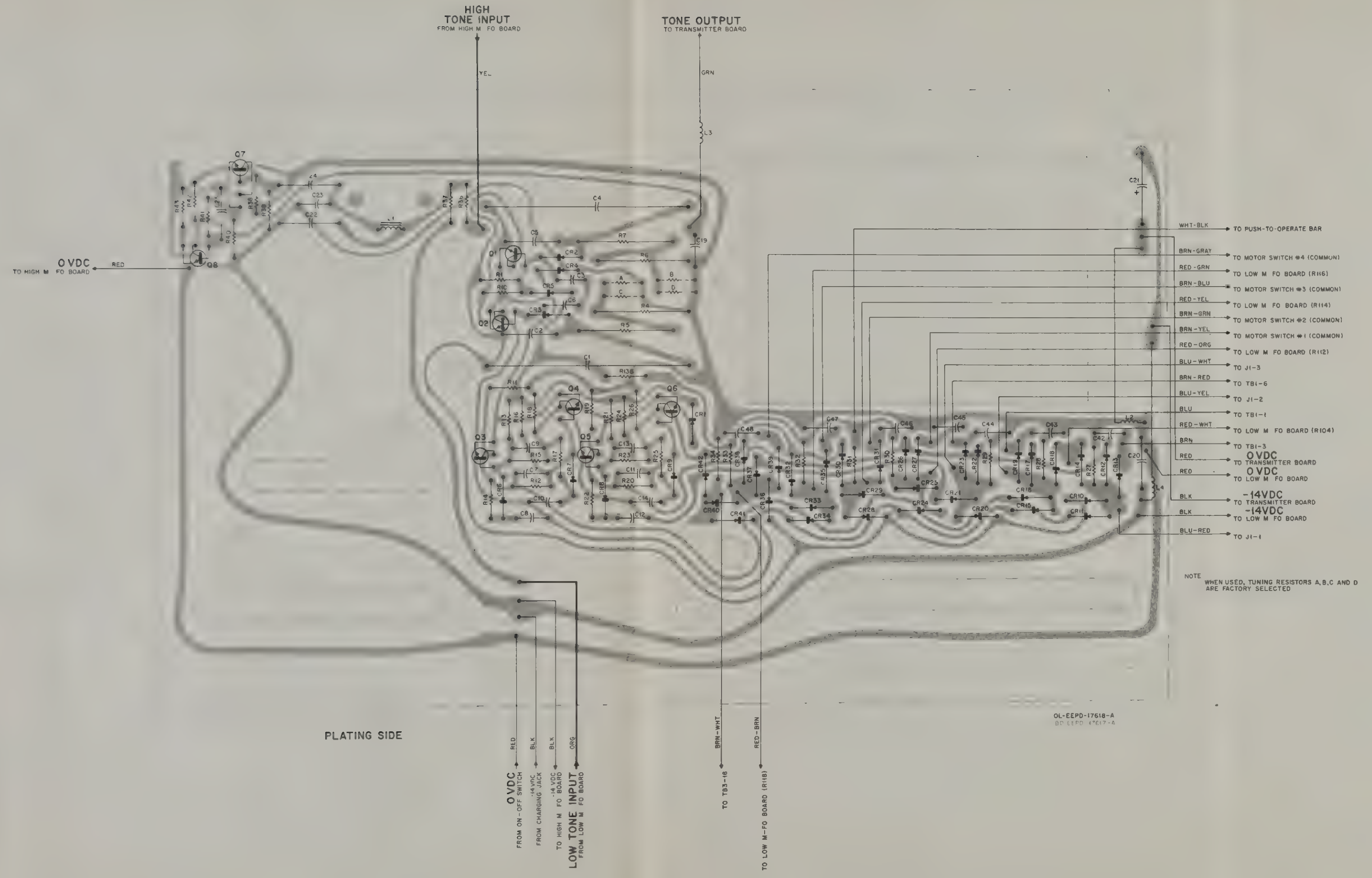
PARTS LIST

CLN6216A Mult. Freq. Osc. (High) EPD-21892-B

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
		CAPACITOR, fixed:
C15, 16, 17	21K832501	.01 uf +60-40%; 250 v
C26, 29	8D83445B20	.015 uf ±5%; 50 v
C27, 28	21D82537B16	.001 uf ±5%; 100 v
		SEMICONDUCTOR DEVICE, diode: (SEE NOTE)
CR43, 44, 45, 46, 47, 48, 49, 60, 61	48C864459	germanium
CR50	48C82392B11	silicon
		TRANSISTOR: (SEE NOTE)
Q9 thru 19	48R869197	N-P-N; type M9197
Q20, 21	48R869570	N-P-N; type M9570
Q32	48R869476	N-P-N; type 2N649
		RESISTOR, fixed: ±1%; 1/4 w; unl stated
R44, 45, 48, 49, 52, 53, 56, 57, 60, 61, 64, 65, 69, 70, 73, 74, 77, 78, 81, 82,	6S128684	56K ±5%
R47, 51, 55, 59, 63, 67, 71, 75, 79, 83	6S131857	680K ±5%
R84	6D82527F18	56.2K; 1/2 w
	or6D82672B22	56.2K
R85	6D82527F16	19.1K; 1/2 w
	or6D82672B66	19K
R86	6D82527F15	9530; 1/2 w
	or6D82672B65	9530
R87	6D82527F11	5620; 1/2 w
	or6D82672B25	5620
R88	6D82527F08	3740; 1/2 w
	or6D82672B26	3740
R89	6D82527F07	2740; 1/2 w
	or6D82672B63	2740
R90	6D82527F05	2000; 1/2 w
	or6D82672B62	2000
R91	6D82527F03	1580; 1/2 w
	or6D82672B61	1580
R92	6D82527F02	1240; 1/2 w
	or6D82672B20	1240
R93	6D82527F13	7150; 1/2 w
	or6D82672B64	7150
R94	6D82672B08	4750; 1/2 w
R95	6S129887	12K ±5%
R96, 97, 100, 103	6D82526F20	2.2K ±5%
R98, 101	6D82672B60	16.5K; 1/8 w
R96	6D83841B03	Thermistor (50K @ 25°C)

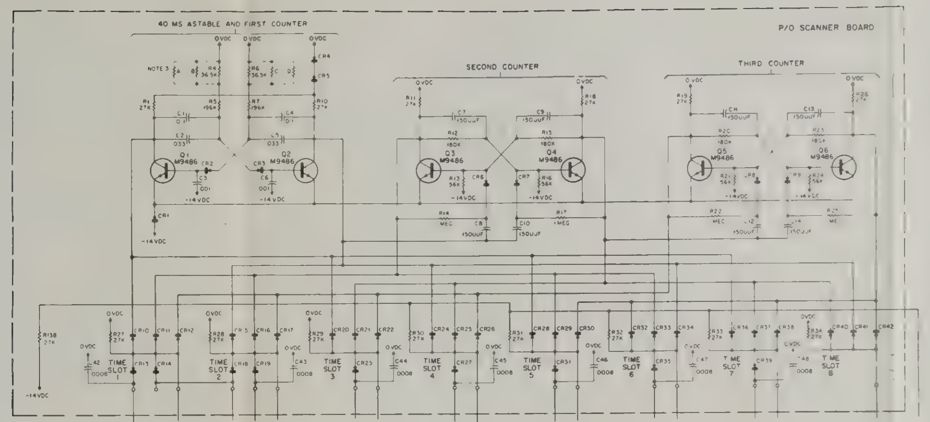
NOTE:

Replacement transistors and diodes must be ordered by Motorola part number only for optimum performance.


HIGH
TONE INPUT
FROM HIGH M FO BOARD
YEL
TONE OUTPUT
TO TRANSMITTER BOARD
GRN
0 VDC
TO HIGH M FO BOARD
RED
C21
WHT-BLK
TO PUSH-TO-OPERATE BAR
BRN-GRAY
TO MOTOR SWITCH #4 (COMMON)
RED-GRN
TO LOW M FO BOARD (R116)
BRN-BLU
TO MOTOR SWITCH #3 (COMMON)
RED-YEL
TO LOW M FO BOARD (R114)
BRN-GRN
TO MOTOR SWITCH #2 (COMMON)
BRN-YEL
TO MOTOR SWITCH #1 (COMMON)
RED-ORG
TO LOW M FO BOARD (R112)
BLU-WHT
TO J1-3
BRN-RED
TO TB1-6
BLU-YEL
TO J1-2
BLU
TO TB1-1
RED-WHT
TO LOW M FO BOARD (R104)
BRN
TO TB1-3
RED
0 VDC
TO TRANSMITTER BOARD
RED
0 VDC
TO LOW M FO BOARD
BLK
-14VDC
TO TRANSMITTER BOARD
BLK
-14VDC
TO LOW M FO BOARD
BLU-RED
TO J1-1
C20
CR13
L2
L4
RED
0VDC
FROM ON-OFF SWITCH
BLK
-14 VDC
FROM CHARGING JACK
BLK
-14 VDC
TO HIGH M FO BOARD
ORG
LOW TONE INPUT
FROM LOW M FO BOARD
BRN-WHT
TO TB3-18
RED-BRN
TO LOW M-FO BOARD (R118)
Q1
Q2
Q3
Q4
Q5
Q6
Q7
Q8
OL-EEPD-17618-A
BD EEPD 17617-A

NOTE
WHEN USED, TUNING RESISTORS A,B,C AND D ARE FACTORY SELECTED

PLATING SIDE


40 MS ASTABLE AND FIRST COUNTER
P/O SCANNER BOARD
SECOND COUNTER
THIRD COUNTER
NOTE 3
0 VDC
R1 27K
R4 36.5K
R5 196K
R6 36.5K
R7 196K
R10 27K
R11 27K
R18 27K
R19 27K
R26 27K
C1 0.1
C4 0.1
C7 150UUF
C9 150UUF
C11 150UUF
C13 150UUF
CR4
CR5
Q1 M9486
Q2 M9486
Q3 M9486
Q4 M9486
Q5 M9486
Q6 M9486
-14VDC
R38 27K
TIME SLOT 1
TIME SLOT 2
TIME SLOT 3
TIME SLOT 4
TIME SLOT 5
TIME SLOT 6
TIME SLOT 7
TIME SLOT 8

VOLTAGE READINGS

TRANSISTOR	BASE	EMITTER	COLLECTOR
Q1	-13.1	-13.7	-8.0
Q2	-13.1	-13.7	-8.0
Q3	-13.4	-13.7	-7.7
Q4	-13.4	-13.7	-7.7
Q5	-13.4	-13.7	-7.7
Q6	-13.4	-13.7	-7.7
Q7	- 4.8	- 5.5	0
Q7	.75 a-c	.71a-c	0 a-c
Q8	- 5.7	- 6.0	-2.5
Q8	.56 a-c	5.6 a-c	90 mv a-c

NOTES.

1. EXCEPT WHERE NOTED ALL VOLTAGE READINGS ARE DC AND REFERENCED WITH RESPECT TO +14 VDC.
2. SOME VOLTAGES WILL BE PULSATING. IN SUCH CASES THE VOLTAGE READING GIVEN IS AN AVERAGE VALUE.

EPD-12360-O

REVISIONS

DIAG. ISSUE	BOARD AND SUFFIX NO.	REF. SYMBOL	CHANGE	LOCATION
A	CLN6160A		ADDED PLATING SIDE DESIGNATION & RELOCATED TRANSMITTER BOARD LEADS	CIRCUIT BD.

PARTS LIST

CLN6160A Scanner Board — EPD-17822-O

REFERENCE SYMBOL	MOTOROLA PART NO	DESCRIPTION
		CAPACITOR, fixed: uf ±5%, 50 v; unl. stated
C1, 4	8D83445B21	0.1
C2, 5	8D82[illegible]	.033 ±10%, 25 v
	or 8D83293B10	.033
C3, 6	21D82537B16	.001; 100 v
C7 thru 14	21K840047	150 uuf; 500 v
C19	21D82428B09	.0047 ±10%, 100 v
C20	21C82372C02	0.2 +80-20%, 25 v
C21	23K865137	4.7 ±20%; 25 v
C22	8C82548E02	.015 ±10%, 100 v
C23	21K859945	390 uuf; 500 v
C24	8C82548E01	.01 ±10%, 100 v
C25	8D82905G01	.01 ±10%, 25 v
C42 thru 48	21B847070	.0008 ±10%, 600 v
		SEMICONDUCTOR DEVICE, diode: (SEE NOTE)
CR1, 4, 5	48K855216	germanium
CR2, 3, 6, 7 thru 42	48C82392B03	silicon
		COIL
L1	25C82190A02	AF: choke; 7 h
L2, 3, 4	24A890687	RF: choke; 2
		TRANSISTOR: (SEE NOTE)
Q1 thru 8	48K869486	N-P-N; type M9486
		RESISTOR, fixed: ±5%, 1/4 w, unl. stated
R1, 10, 11, 18, 19, 26, 27, 28, 29, 30, 31, 32, 33, 34, 138	6S129886	27K
R4, 6	6D82672B31	36.5K ±1%
R5, 7	6D82672B30	196K ±1%
R12, 15, 20, 23	6S124B04	180K
R13, 16, 21, 24	6S128684	56K
R14, 17, 22, 25, 39	6S129189	1 meg
R36, 37	6S124A97	100K
R38	6S129149	470K
R40	6S129526	33K
R41	6S129983	8.2K
R42	6S129863	390 ±10%
R43	6S129681	1.5K

NOTE:

Replacement transistors and diodes must be ordered by Motorola part number only for optimum performance.

CLN6160A Scanner Circuit Board Detail
Motorola No. PEPD-17616-A
8/28/68-RS

RECEIVER - DECODER DIAGRAMS

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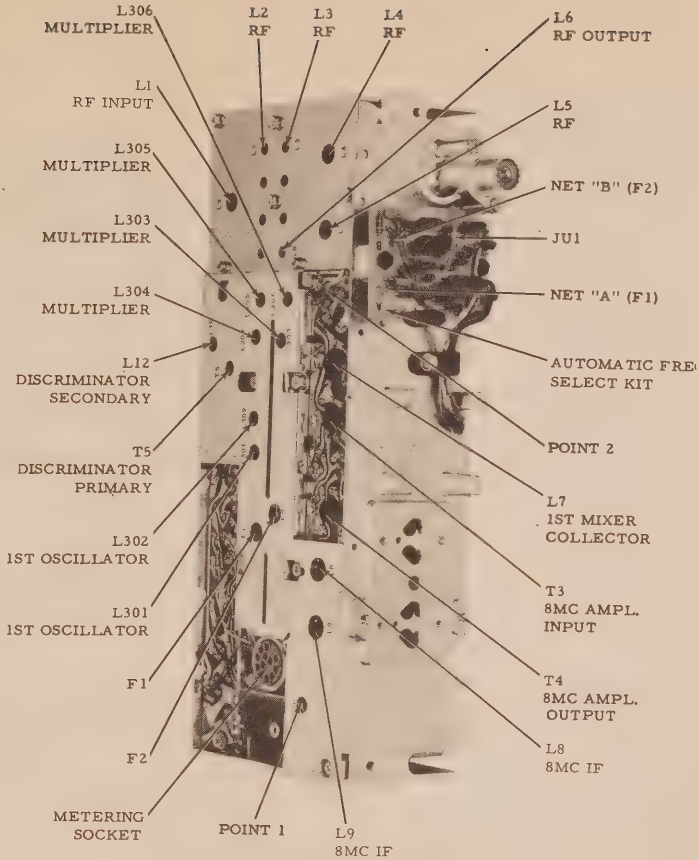
L306
MULTIPLIER
L2
RF
L3
RF
L4
RF
L6
RF OUTPUT
L1
RF INPUT
L5
RF
L305
MULTIPLIER
NET "B" (F2)
JU1
L303
MULTIPLIER
NET "A" (F1)
L304
MULTIPLIER
L12
DISCRIMINATOR
SECONDARY
AUTOMATIC FRE
SELECT KIT
POINT 2
T5
DISCRIMINATOR
PRIMARY
L7
1ST MIXER
COLLECTOR
L302
1ST OSCILLATOR
T3
8MC AMPL.
INPUT
L301
1ST OSCILLATOR
F1
T4
8MC AMPL.
OUTPUT
F2
L8
8MC IF
METERING
SOCKET
POINT 1
L9
8MC IF

AEPD-21894-0

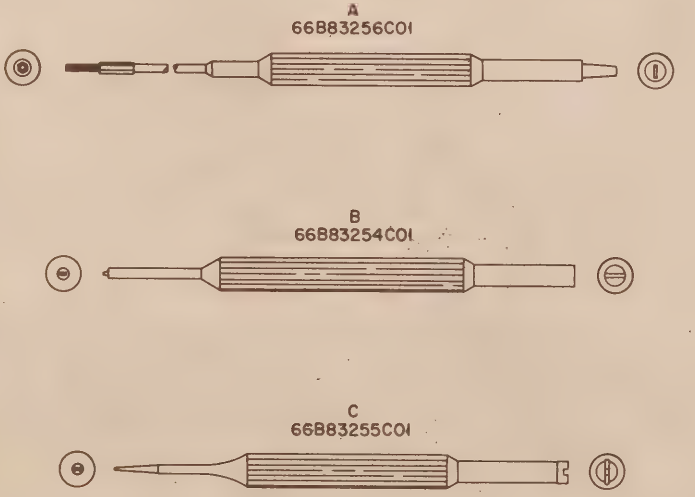
A
66B83256C01
B
66B83254C01
C
66B83255C01

DIAGRAM NO. BEPD-21499-0

ALIGNMENT CONTINUED ON REVERSE SIDE

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A. TEST EQUIPMENT REQUIRED

1. Motorola Model S1056A-9A Portable Test Set with a Motorola Model TKN6025A Adapter Cable (available on separate order) must be used. Also two coaxial cables; one for the output of the 455 kc oscillator on the test set (at least two feet long), and the other for the i-f output of the signal generator.
2. Motorola Model T1035A Signal Generator(or equivalent) with a Boonton Model 80-ZH1 Pad (6 db, 50 ohm) on the rf output.
3. Motorola Model TLN6845A Tuning Tool Kit. A small screwdriver may be used for some of the alignments.
4. Control Transmitter Unit associated with this receiver (for netting).
5. Motorola Model AC Voltmeter (or equivalent).
6. Hewlett Packard Model 355D VHF Variable Attenuator (0.5 watt, 50 ohm) or equivalent.
7. Motorola Model TEK-23 Power Supply (or equivalent). If the power supply used does not have a built-in dc voltmeter, a ±5% type must be used.
8. A three-foot coaxial cable with two uhf connectors for connecting the rf output to the receiver.

B. HOW TO SET UP THE S1056-9A PORTABLE TEST SET

1. Set function selector switch to RCVR position.
2. Turn the test selector to position 4. If the meter does not read zero on the top scale, adjust the potentiometer until it does. It is important that an exact zero be obtained prior to aligning the receiver.
3. Set the dial below the meter to the OFF position.
4. Connect 20-pin meter cable plug to test set; connect the adapter cable to the cable coming from the test set; connect the other end of the adapter cable to the receiver metering socket. When the test set is not in use, disconnect the 20-pin metering cable to conserve internal battery life. The plug on the cable acts as an on-off switch completing the battery circuit. When this is not convenient, turn the test set selector to position 1 or 2.

NOTE

> For one-frequency systems, place the channel element in the F1 position and the red jumper JU1 (on the automatic frequency select board) to the NET "A" (F1) position. See illustration. When finished, return jumper to the unmarked position.

C. HOW TO SET UP THE SIGNAL GENERATOR FOR 8 MC IF ALIGNMENT

1. Set up the signal generator according to the instructions supplied with the unit. Allow 30 minutes warm-up.
2. Remove the first oscillator crystal(s).
3. Set the generator in the CW mode.
4. Turn on the i-f on the generator and set the attenuator to about mid-range.
5. Connect the i-f output of the generator to the 50-ohm variable attenuator, and via a 0.003 uf capacitor to POINT 2 (first mixer). See illustration.

NOTE

> It is recommended that the probe be soldered to POINT 2 after first turning off the power supply. A good connection provides for accurate tuning.

6. With zero attenuation on the variable pad between the generator and receiver, switch the test set to position 4.
7. Slowly rotate the signal generator frequency dial near the 8 mc setting. Observe the test set meter. When the critical point is reached, the meter indicator will become extremely sensitive to frequency changes. It will swing first to one side of the zero on the top scale, and then as the dial is further rotated in the same direction, the indicator will swing to the other side.
8. Set the dial for zero in the middle of this "S" curve. This is a critical adjustment.

D. HOW TO SET UP SIGNAL GENERATOR FOR RF ALIGNMENT

1. Set up the signal generator according to the instructions supplied with the unit. Allow 30 minutes warm-up.
2. Connect the signal generator (rf output) cable to the receiver antenna input.
3. Turn the generator output up to maximum.
4. Make sure the i-f switch on the generator is turned to off and that the generator is in the CW mode.
5. Switch the test set to position 4.
6. Slowly rotate the signal generator frequency dial near the resonant frequency of the receiver. When the critical point is reached, the meter indicator will become extremely sensitive to frequency changes. It will swing first to one side of the zero on the top scale, and then as the dial is further rotated in the same direction, the indicator will swing to the other side.
7. Set the dial for zero in the middle of this "S" curve. This is a critical adjustment.

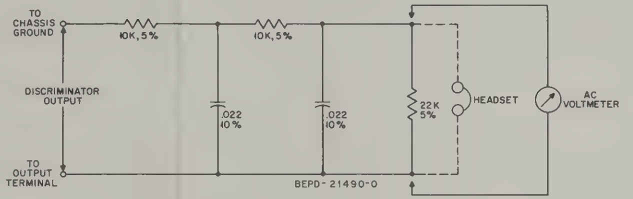
E. FREQUENCY CALCULATIONS

$$f_1 = \frac{f_c + 8\ \text{mc}}{6}$$

where: f_1 = 1st oscillator crystal frequency

f_c = carrier frequency

F. DISCRIMINATOR OUTPUT FILTER



Discriminator Output Filter

When the decoder is not connected to the output of the receiver, this filter should be used. The discriminator output filter not only acts as a load, but aids in receiver alignment. The ac voltmeter, connected across the output of the filter (22K resistor), is used throughout the alignment of the receiver. By placing a pair of headsets across the output, the signal generator may be tuned until the carrier is located. (A null in the noise output indicates the presence of a carrier.)

Note that the headset must be removed when the actual alignment of the receiver is accomplished.

This filter is not supplied with the receiver, but may be made from available parts. The schematic diagram of the circuit is shown here to aid in its construction.

G. HOW TO MEASURE 20 DB QUIETING SENSITIVITY

1. Set up the test set according to instructions in paragraph B.
2. Connect the filter shown in paragraph F to the output of the discriminator (pins #1 and #5 of the power plug).
3. Connect the ac voltmeter across the 22K ohm resistor of the filter.

NOTE

> If the voltmeter is operated from the ac line rather than battery, use an ungrounded isolation plug to avoid ground problems. Prior to making any tests. power should be on the receiver for at least 4 minutes.

4. Perform the steps described in paragraph D.
5. Reduce the generator output to zero and change the frequency band. Don't rotate the frequency dial since it is already set for the resonant frequency of the receiver.
6. Note the noise reading on the ac voltmeter.
7. Return the generator to the frequency band of the receiver, and increase the output to about 1 microvolt. If the test set indicator has changed from its previous zero reading, readjust the frequency as described in paragraphs D.6. and D.7.
8. Reduce the output until the ac voltmeter reading is 1/10 of that measured in step 6. above. Once again check the frequency and readjust, if necessary. The attenuator setting (in microvolts) represents the 20 db quieting sensitivity value for the receiver.

H. TEST SET SELECTOR SWITCH POSITIONS

S1056A-9A TEST SETS	1	2	4	5	6
CIRCUIT METERED	455 KC IF Ampl. #2	455 KC IF Ampl. #3	Discrim. Secondary	Discrim. Primary	1st. Oscillator

I. RECEIVER ALIGNMENT

NOTE

> In aligning the discriminator and rf deck, it is necessary to position the slugs as indicated for correct receiver performance. Also, before performing any tests, power should be applied to the receiver for at least 4 minutes, and 8 minutes before an on-frequency check.

1. INPUT VOLTAGE

Set the voltage on the power supply for 14 volts dc. If no meter is present on the power supply, measure the voltage across pins 5(-) and 6(+) of the power connector in the receiver with a dc voltmeter.

2. DISCRIMINATOR PRIMARY

a. Set up the test set as described in paragraph B.
b. Switch on the 455 kc oscillator on the test set and allow it to warm up for several minutes.
c. Connect a coaxial cable to the rf terminal on the test set.
d. Using the screwdriver end of tuning tool B (see illustration), turn the slug in L12 counterclockwise until it protrudes about 1/8 inch above the printed circuit board end of the coil form.
e. Switch test set to position 5.
f. Couple the oscillator through a 2 uuf capacitor to the base of the second mixer (point 1 on illustration).

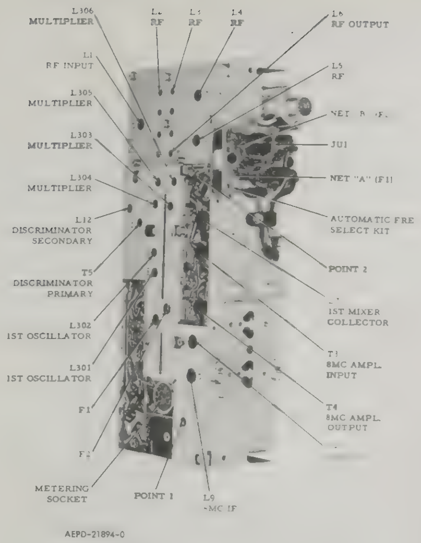
NOTE

> It is recommended that the probe be soldered to POINT 1 after first turning off the power supply.

g. Using the screwdriver end of tuning tool B, adjust T5 for a maximum reading.

NOTE

> Two peaks within one or two turns of each other will be found. Tune to the greater of the two peaks.



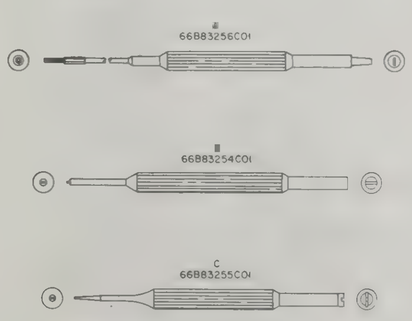


DIAGRAM NO BEPD-21499-0

ALIGNMENT CONTINUED ON REVERSE SIDE

STAGE MEASUREMENTS WITH THE RECEIVER PROPERLY ALIGNED

E UT	INPUT TO		FREQUENCY	METER POSITION	TEST SET METER READING
	Antenna Disconnected			1	2.0 ua
	Antenna Disconnected			2	26 ua
	Antenna Disconnected			4	0
	Antenna Disconnected			5	20 ua
	Antenna Disconnected			6	5 ua
	Antenna Connector		Carrier Freq.		20 DB Quieting
	Antenna Connector		Carrier Freq.	1	10 ua
	Base	RF Transistor Q1	Carrier Freq.	1	10 ua
	Collector				
	Base	1st mixer (Q5)	Carrier Freq.		20 DB Quieting
	Collector		8 mc	1	10 ua
	Base	8 mc IF Transistor (Q6)	8 mc	1	10 ua
	Collector				
	Base	2nd Mixer (Q7)	8 mc	1	10 ua
	Collector		455 kc	1	10 ua
	Base	455 kc Ampl. Transistor (Q9) in 455 kc filter	455 kc	1	10 ua
	Collector				
	Base	1st 455 kc IF istor (Q10)	455 kc	1	10 ua
	Collector				

STAGE MEASUREMENT NOTES

1. All measurements made with signal generator tuned to required frequency.
2. All measurements, except antenna input, taken with 50 ohm terminated cable with a 0.003 uf capacitor in series.
3. First mixer quieting is measured with the rf input lead to the 8 mc i-f strip disconnected.

3. DISCRIMINATOR SECONDARY

a. With the oscillator still coupled to point 1, switch test set to postion 4.
b. Using the screwdriver end of tuning tool B, adjust L12 for an absolute zero on the "0" center (top) scale. This adjustment is critical and should be exactly on zero. The zero is in the middle of an "S" curve, as described in paragraph D.6.
c. Turn off the oscillator and disconnect the probe.

4. 8 MC IF

a. Set up the signal generator as discussed in paragraph C.
b. Switch test set to position 1.
c. Increase the attenuation on the variable pad until the 50-microamp scale on the test set shows a reading of 5.
d. Switch back to position 4 to insure that the frequency has not changed. Readjust for a zero if necessary.
e. Switch back to position 1.

NOTE

If the meter reading appears to be sensitive to such things as movement of the coaxial cable, be sure not to disturb the system during the following tuning procedure.

f. Using the wide screwdriver end of tuning tool C, tune L9, L8, T4, T3 and L7, in that order, for a maximum meter indication. If the meter reading goes above 10 on the 50-microamp scale, increase the attenuation. Each time this is done repeat step d. above.
g. Turn off the i-f on the generator and disconnect the probe.
h. Replace the first oscillator crystal(s) in the receiver. Wait 4 minutes before performing further tests.

NOTE

In making the following adjustments on coils L301 through L306, make sure not to lower the slugs against the shield cans or cores may break.

5. FIRST OSCILLATOR

a. Disconnect the generator from the receiver and turn the output to zero.
b. Position the "warping" capacitor so that the screwdriver slot is perpendicular to the length of the board.
c. Switch test set to position 6.
d. Using the screwdriver end of tuning tool B, alternately adjust coils L301 and L302 for a maximum meter reading. L301 may appear rather flat at its maximum meter indication.
e. Continue this procedure until the meter reading no longer increases.

6. MULTIPLIER

a. Set up the signal generator as described in paragraph D.
b. If the "S" curve described in paragraph D.6. is not found, disconnect the cable from the antenna receptacle and connect it to point 2. Switch to position 1 on the test set and rough tune L304, L305, L303 and L306, in that order, for a maximum meter indication (with the generator frequency as close to the resonant frequency of the receiver as can be approximated on the dial). Now switch back to position 4, reconnect the cable to the antenna receptacle and perform the adjustments in paragraph D.6. and D.7.
c. Turn the test set to position 1.
d. Apply only as much signal as necessary to produce a small meter indication. If the rf deck is badly detuned, it may be necessary to use position 2. Return to position 1 when possible.
e. Each time the attenuator is varied in this alignment, switch back to position 4 and check for an exact zero reading. If necessary, readjust the frequency, then return to position 1.
f. Using the screwdriver end of tuning tool B, align L304, L305, L303 and L306, in that order, for a maximum meter indication.
g. If necessary, readjust the generator output to keep the meter reading quite low. Repeat step e. above each time.
h. Repeak these coils in the same order.

7. RF DECK (TOUCH UP)

If a routine rf alignment is being performed, use the following procedure. Do not use this method unless the rf deck has previously been completely tuned. The reason is that some coils have two peaks, and it is important the the correct peak be found.

a. Set up the signal generator as described in paragraph D.
b. Switch the test set to position 1 and check for a meter reading. If one is not apparent, vary the frequency slightly as the generator may not be tuned exactly to the resonant frequency of the receiver.
c. Reduce the generator output until the meter reading is below 10 on the 50 microamp scale. Switch test set to position 4 and readjust the frequency, if necessary, for an exact zero reading. In the following tuning procedure, readjust the output for a reading below 10 whenever necessary, and make the above frequency check each time.
d. Switch test set to position 1.
e. Using the hex end of tuning tool A for L1, L4 and L5, and the narrow screwdriver end of tuning tool C for L2, L3 and L6, tune L1, L2, L3, L4, L5, and L6, in that order, for a maximum meter indication.
f. Recheck the frequency on position 4.
g. Repeat the above tuning sequence and frequency check until the meter reading no longer increases.
h. To insure the correct tuning of L6, turn the L306 slug until it lightly touches the shield can. Then back off slightly. DO NOT LOWER THIS SLUG TOO HARD, OR CORE MAY BREAK.
i. With the test set in position 1, peak L6 (this is a critical peak) and then retune L306 for a maximum reading.

8. RF DECK (COMPLETE REALIGNMENT)

If a complete rf deck realignment is required because of rf deck replacement, extensive rework or retuning to a new frequency, the following procedure must be used due to high selectivity of the rf deck.

a. Pre-position L1 and L5 slugs by turning them clockwise until the slug ends are flush with the coil end forms opposite the shield plate. Use the hex end of tuning tool A.
b. Using the same tool for L4, and the narrow screwdriver end of tuning tool C for L2, L3 and L6, turn these slugs counterclockwise until they are flush with the shield plate ends of the coil forms.
c. Set up the signal generator as described in paragraph D.
d. The peak for L6 may be near the end of the coil form. Bring its slug slightly above the end of the form.
e. Switch to position 1 on the test set. Make sure the signal generator output is turned low enough so that the meter reading is below 10 on the 50 microampere scale. This also applies to the following alignment. Readjust the output attenuator whenever the meter indication exceeds 10. However, each time the attenuator is changed switch to position 4 and if necessary, readjust the frequency for an exact zero on the top scale. Then switch back to position 1.
f. If after pre-positioning the six slugs no meter reading is apparent in position 1, slowly turn L2 and L3 clockwise a few turns and watch for a meter indication.

NOTE

If this step shows no meter reading, switch to position 2 for the initial stages of the following tuning procedure. Switch back to position 1 whenever a meter indication appears.

g. Tune L1, L2, L3, L4, L5, and L6, in that order, for a maximum meter reading. As mentioned above, check the frequency whenever the attuenator is changed.

NOTE

When the cores are tuned toward the coil, the desired peak will appear first.

h. Since tuning interaction occurs when the coils are far from resonance, repeat the above tuning sequence several times until the meter reading no longer increases. After each sequence switch to position 4 and check the frequency.
i. To insure the correct tuning of L6, turn the L306 slug until it lightly touches the shield can. Then back off slightly. BE CAREFUL NOT TO BREAK THE CORE WHEN TOUCHING THE CAN.
j. With the test set in position 1, peak L6 (a critical peak), and then retune L306 for a maximum reading.

9. ON-FREQUENCY ADJUSTMENT

a. Transmit a carrier from a PRC control transmitter known to be on the frequency at which the receiver is normally intended to operate. (An explanation follows this procedure so it can be used for two-frequency receivers).
b. Set the selector switch on the test set to position 1. If the receiver is on the same frequency as the transmitter, the meter reading should increase as the transmitter is keyed.

NOTE

If necessary, connect an antenna to the receiver.

c. Repeat step b. with the selector switch in position 2.
d. Switch the test set to position 4.
e. A zero reading on the "0" center scale indicates an on-frequency condition. If an exact zero reading is not present, adjust the "warping" capacitor on the receiver until it is.

NOTE

DO NOT READJUST COILS L301 AND L302.

J. ALIGNMENT PROCEDURE MODIFICATIONS FOR TWO-FREQUENCY RECEIVERS

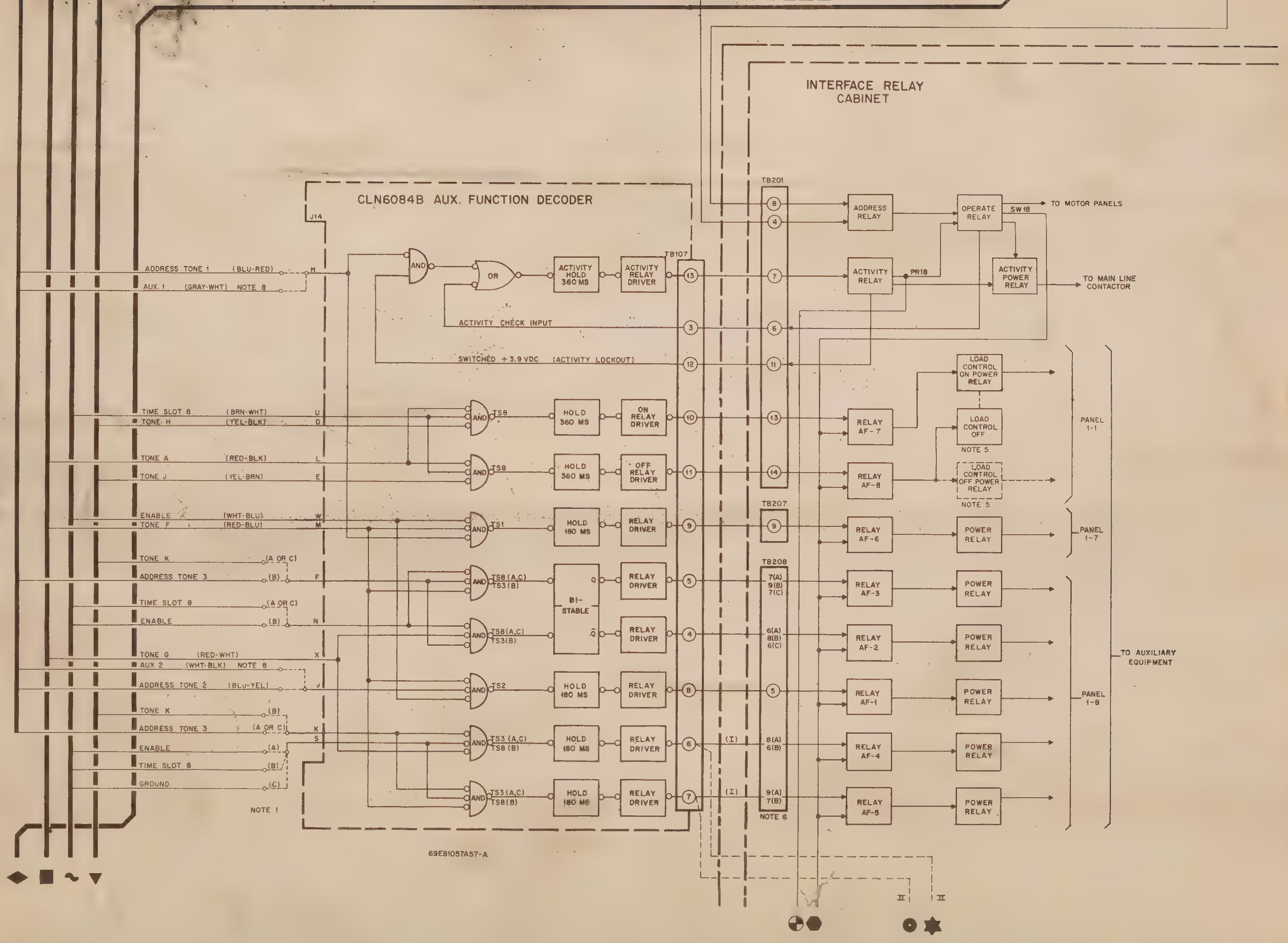
1. Move the red jumper JU1 on the CLN6206A Automatic Frequency Select Board (near the antenna receptacle) from the neutral terminal to terminal A.
2. Align and quiet the receiver at the rf frequency corresponding to the channel element in position F1, as previously described.
3. Move jumper JU1 to terminal B, change the input frequency to that of the channel element in position F2, and check the 20 db quieting once more. As before, it should be 0.4 microvlots or less.
4. Using a transmitter with a frequency corresponding to the channel element in position F2, repeat the on-frequency adjustment in paragraph E. 9.

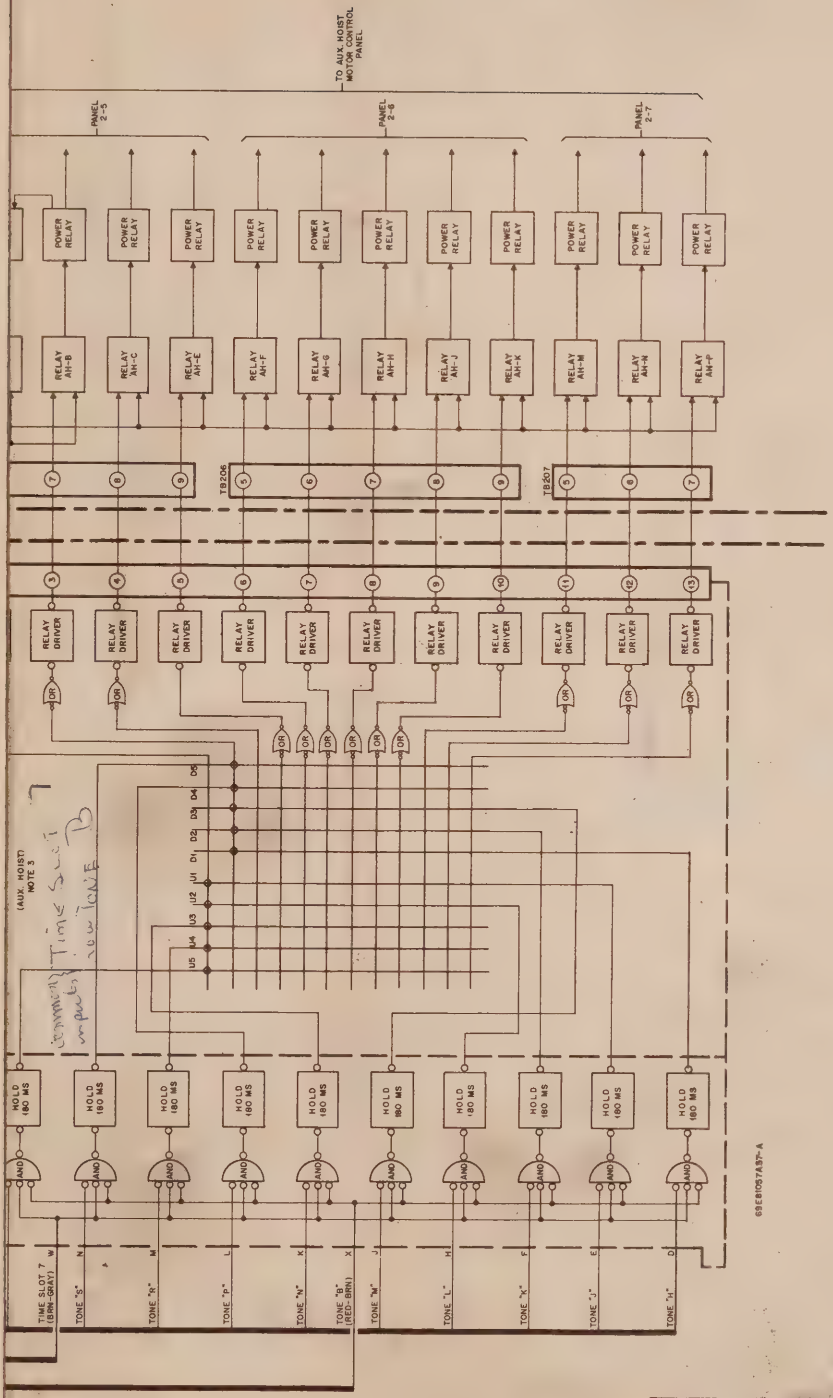
K. AVERAGE STAGE MEASUREMENTS WITH THE RECEIVER PROPERLY ALIGNED

APPROXIMATE MICROVOLT INPUT	INPUT TO		FREQUENCY	METER POSITION	TEST SET METER READING
No Signal	Antenna Disconnected			1	2.6 ua
No Signal	Antenna Disconnected			2	26 ua
No Signal	Antenna Disconnected			[illegible]	0
No Signal	Antenna Disconnected			[illegible]	20 ua
No Signal	Antenna Disconnected			[illegible]	5 ua
0.4	Antenna Connector		Carrier Freq.		20 DB Quieting
0.6	Antenna Connector		Carrier Freq.	1	10 ua
0.6	Base	RF Transistor Q1	Carrier Freq.	1	10 ua
18	Collector				
2.5	Base	1st mixer (Q5)	Carrier Freq		20 DB Quieting
140	Collector		8 mc	1	10 ua
12.5	Base	8 mc IF Transistor (Q6)	8 mc	1	10 ua
160	Collector				
8.0	Base	2nd Mixer (Q7)	8 mc	1	10 ua
450	Collector		455 kc	1	10 ua
110	Base	455 kc Ampl. Transistor (Q9) in 455 kc filter	455 kc		10 ua
4500	Collector				
1600	Base	1st 455 kc IF istor (Q10)	455 kc	1	10 ua
60000	Collector				

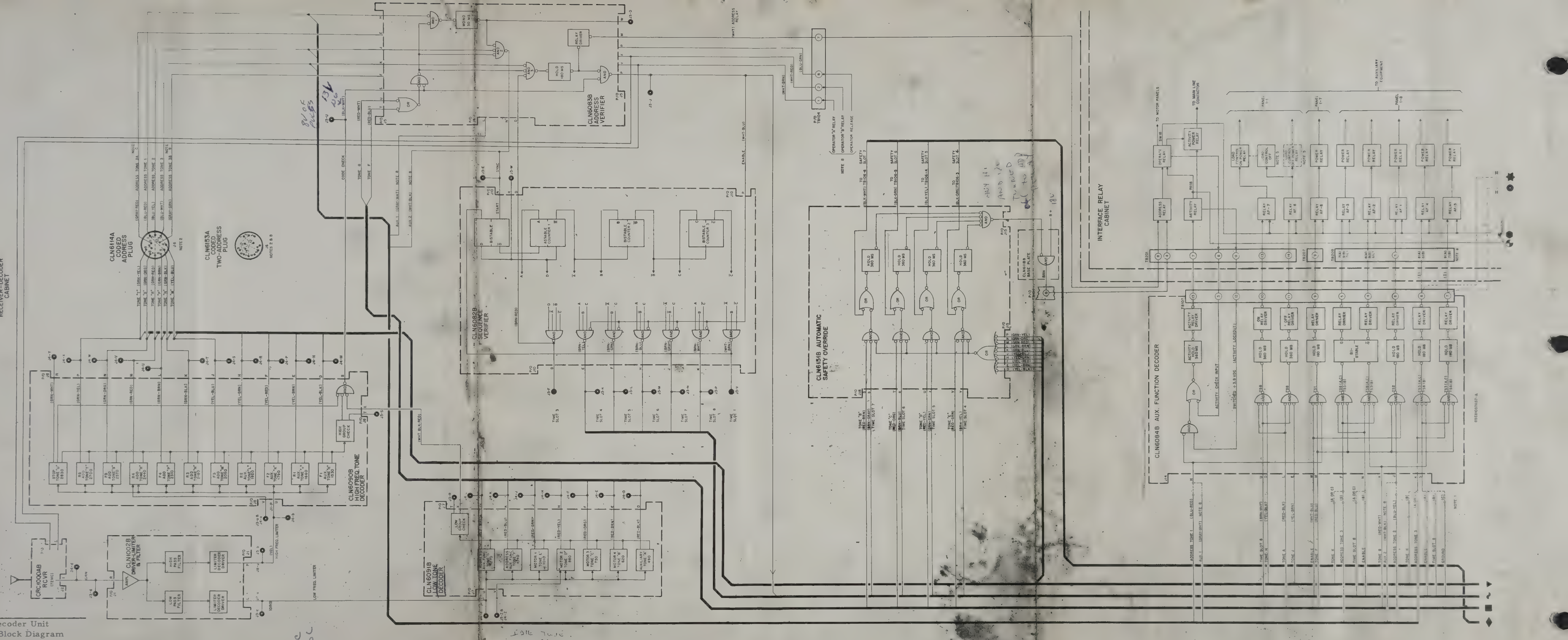
STAGE MEASUREMENT NOTES

1. All measurements made with signal generator tuned to required frequency.
2. All measurements, except antenna input, taken with 50 ohm terminated cable with a 0.003 uf capacitor in series.
3. First mixer quieting is measured with the rf input lead to the 8 mc i-f strip disconnected.


INTERFACE RELAY CABINET
CLN6084B AUX. FUNCTION DECODER
J14
TB107
TB201
TB207
TB208
ADDRESS TONE 1 (BLU-RED) H
AUX. 1 (GRAY-WHT) NOTE 8
AND
OR
ACTIVITY HOLD 360 MS
ACTIVITY RELAY DRIVER
ACTIVITY CHECK INPUT
SWITCHED +3.9 VDC (ACTIVITY LOCKOUT)
TIME SLOT 8 (BRN-WHT) U
TONE H (YEL-BLK) D
TONE A (RED-BLK) L
TONE J (YEL-BRN) E
ENABLE (WHT-BLU) W
TONE F (RED-BLU) M
TONE K (A OR C)
ADDRESS TONE 3 (B) F
TIME SLOT 8 (A OR C)
ENABLE (B) N
TONE G (RED-WHT) X
AUX 2 (WHT-BLK) NOTE 8
ADDRESS TONE 2 (BLU-YEL) J
TONE K (B)
ADDRESS TONE 3 (A OR C) K
ENABLE (A) S
TIME SLOT 8 (B)
GROUND (C)
NOTE 1
TS8
TS1
TS8 (A,C)
TS3 (B)
TS2
TS3 (A,C)
TS8 (B)
HOLD 360 MS
HOLD 180 MS
BI-STABLE
Q
Q̄
ON RELAY DRIVER
OFF RELAY DRIVER
RELAY DRIVER
13
3
12
10
11
9
5
4
8
6
7
(I)
14
7(A) 9(B) 7(C)
6(A) 8(B) 6(C)
8(A) 6(B)
9(A) 7(B)
NOTE 6
ADDRESS RELAY
ACTIVITY RELAY
PR18
OPERATE RELAY
SW18
ACTIVITY POWER RELAY
TO MOTOR PANELS
TO MAIN LINE CONTACTOR
RELAY AF-7
RELAY AF-8
RELAY AF-6
RELAY AF-3
RELAY AF-2
RELAY AF-1
RELAY AF-4
RELAY AF-5
LOAD CONTROL ON POWER RELAY
LOAD CONTROL OFF
NOTE 5
LOAD CONTROL OFF POWER RELAY
NOTE 5
POWER RELAY
PANEL 1-1
PANEL 1-7
PANEL 1-8
TO AUXILIARY EQUIPMENT
II
II
69E81057A57-A

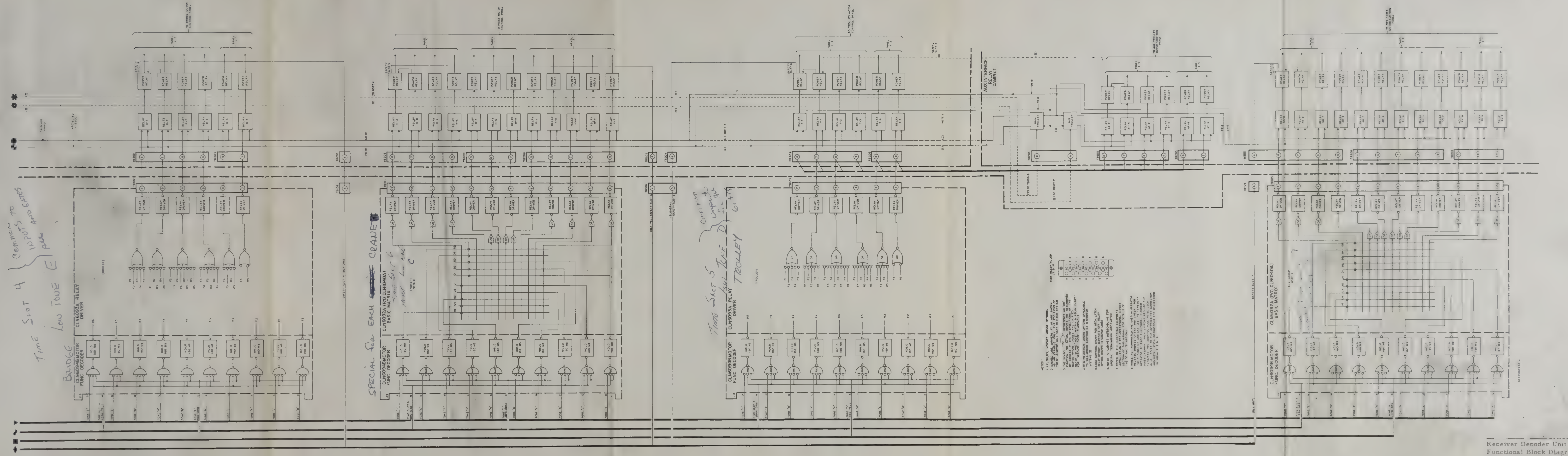

TO AUX. HOIST MOTOR CONTROL PANEL
PANEL 2-5
PANEL 2-6
PANEL 2-7
POWER RELAY
RELAY AH-B
RELAY AH-C
RELAY AH-E
RELAY AH-F
RELAY AH-G
RELAY AH-H
RELAY AH-J
RELAY AH-K
RELAY AH-M
RELAY AH-N
RELAY AH-P
TB206
TB207
RELAY DRIVER
OR
D5
D4
D3
D2
D1
U1
U2
U3
U4
U5
(AUX. HOIST) NOTE 3
common} Time Slot 7
inputs, now TONE B
HOLD 180 MS
AND
TIME SLOT 7 (BRN-GRAY) W
TONE "S" N
TONE "R" M
TONE "P" L
TONE "N" K
TONE "B" (RED-BRN) X
TONE "M" J
TONE "L" H
TONE "K" F
TONE "J" E
TONE "H" D
69E81057A57-A

Receiver Decoder Unit
Functional Block Diagram
Motorola No. 69E81057A57-A
(Sheet 2 of 2)
8/28/68-RS


RECEIVER-DECODER CABINET
CLN6114A CODED ADDRESS PLUG
CLN6153A CODED TWO-ADDRESS PLUG
CLN6090B HIGH FREQ. TONE DECODER
CLN6091B LOW TONE DECODER
CLN1002B DRIVER-LIMITER & FILTER
CRC1004B RCVR
HIGH PASS FILTER
LOW PASS FILTER
LIMITER DECODER DRIVER
CLN6082B SEQUENCE VERIFIER
CLN6083B ADDRESS VERIFIER
CLN6151B AUTOMATIC SAFETY OVERRIDE
CLN6084B AUX. FUNCTION DECODER
INTERFACE RELAY CABINET
RELAY DRIVER
HOLD 180 MS
BISTABLE COUNTER
TIME SLOT
POWER RELAY
TO AUXILIARY EQUIPMENT
TO MOTOR PANELS
TO MAIN LINE CONTROLLER
IDLE TONE 1400~

Receiver Decoder Unit
Functional Block Diagram
Motorola No. 69E81057A57-A
(Sheet 1 of 2)
8/28/68-RS

= 0VDC
= +14VDC
RL ONLY


Time Slot 4 Low Tone E
Common to inputs and gates pre
BRIDGE
CLN6094B MOTOR FUNC DECODER
CLN6093A RELAY DRIVER
(BRIDGE)
SPECIAL for EACH ~~[illegible]~~ CRANE
CLN6092A (P/O CLN1040A) BASIC MATRIX
Time Slot 6 [illegible]
C
(HOIST) NOTE 3
SAFETY SLOT 4 (BLK-ORG)
(BLK-YEL) SAFETY SLOT 6
(BLK-GRN) SAFETY SLOT 5
Time Slot 5 [illegible] D
Common inputs [illegible] gates
TROLLEY
(TROLLEY)
AUX INTERFACE RELAY CABINET
RELAY DRIVER
HOLD 180 MS
POWER RELAY
NOTES

Receiver Decoder Unit
Functional Block Diagram
Motorola No. 69E81057A57-A
(Sheet 2 of 2)
8/28/68-RS

ETY OVERRIDE CIRCUIT

	A.W.G.	WIRE	
OR	NO.	COMES FROM	GOES TO
	20	J11-C	
	18	TB1-1	
	20		J3-A
K	24	J11-D	J14-D
N	24	J11-E	J14-E
D	24	J11-F	J14-F or K
N	24	J11-H	J13-H
U	24	J11-J	J13-J
K	24	J11-K	J13-K
N	24	J11-L	J13-L
D	24	J11-M	J13-M
G	24	J11-N	J13-N
L	24	J11-P	J13-P
K	24	J11-X	J14-L
N	24	J11-V	
G	24	J4-F	
L	24	J4-H	J12-X
N	24	J4-J	J13-X
U	24	J11-R	J14-M
T	24	J11-S	J14-X
L	24	J13-W	J10-E
N	24	J12-W	J10-F
U	24	J3-M	
AY	24		J11-W
T	24	J14-U	J117
K-RED	24		ASO GATE BD.

TB1

A. W. G.	WIRE	
NO.	COMES FROM	GOES TO
16	TB104-5	
18	J1-B	
18	J2-B	
18	J4-B	
18	J3-B	
18	J5-B	
18	J10-B	
18	J9-B	

ARE JUMPED TOGETHER BY BARE #16 A. W. G.

TB2

A. W. G.	WIRE	
NO.	COMES FROM	GOES TO
18	J8-B	
18	J7-B	
18	J11-B	
18	J14-V	J14-B
18	J13-B	
18	J12-B	

TB104

	A. W. G.	WIRE	
R	NO.	COMES FROM	GOES TO
RN	20	J5-V	J2-3
ED	20	J5-X	J2-4
	20	C1-1	J1-A
	16	C1-2	TB1-1
	20	ASO GATE BOARD	
	20	J5-M	
RN	24	J5-R	

USED TO TERMINATE WIRES TO
ODER CABINET.

CLN6132B JUMPER PLUG

P1, JUMPER PLUG

PIN			A.W.G.	WIRE	
NO.	FUNCTION	COLOR	NO.	COMES FROM	GOES TO
A	B+	RED	20		P1-C
C	B+	RED	20	P1-A	

PART OF CLN6119B EXPANSION DECK

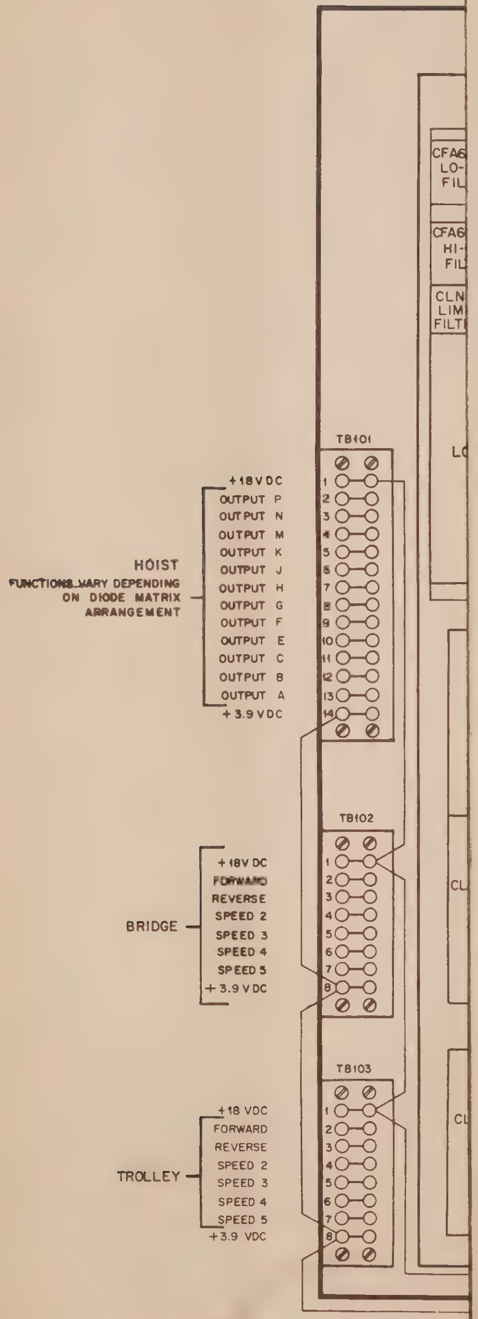
J20, MOTOR FUNCTION DECODER (AUXILIARY HOIST)

PIN			A.W.G.	WIRE	
NO.	FUNCTION	COLOR	NO.	COMES FROM	GOES TO
A ‡	B+	RED	20	P1-A	
B	GND	BLK	20	P1-B	
C ‡	B+	RED	20	P1-C	
D	TONE H	YEL-BLK	24	P1-D	
E	TONE J	YEL-BRN	24	P1-E	
F	TONE K	YEL-RED	24	P1-F	
H	TONE L	YEL-GRN	24	P1-H	
J	TONE M	YEL-BLU	24	P1-J	
K	TONE N	GRN-BLK	24	P1-K	
L	TONE P	GRN-BRN	24	P1-L	
M	TONE R	GRN-RED	24	P1-M	
N	TONE S	GRN-ORG	24	P1-N	
P	TONE T	GRN-YEL	24	P1-P	
W	TIME SLOT 7	BRN-GRY	24	P1-W	
X	TONE B	RED-BRN	24	P1-V	

PART OF CLN6119B EXPANSION DECK

P1, EXPANSION DECK

PIN	FUNCTION	COLOR	A.W.G.	WIRE	
NO.			NO.	COMES FROM	GOES TO
A ‡	B+	RED	20		J20-A
B	GND	BLK	20		J20-B
C ‡	B+	RED	20		J20-C
D	TONE H	YEL-BLK	24		J20-D
E	TONE J	YEL-BRN	24		J20-E
F	TONE K	YEL-RED	24		J20-F
H	TONE L	YEL-GRN	24		J20-H
J	TONE M	YEL-BLU	24		J20-J
K	TONE N	GRN-BLK	24		J20-K
L	TONE P	GRN-BRN	24		J20-L
M	TONE R	GRN-RED	24		J20-M
N	TONE S	GRN-ORG	24		J20-N
P	TONE T	GRN-YEL	24		J20-P
V	TONE B	RED-BRN	24		J20-X
W	TIME SLOT 7	BRN-GRY	24		J20-W


TB101
+18VDC
OUTPUT P
OUTPUT N
OUTPUT M
OUTPUT K
OUTPUT J
OUTPUT H
OUTPUT G
OUTPUT F
OUTPUT E
OUTPUT C
OUTPUT B
OUTPUT A
+3.9VDC
HOIST
FUNCTIONS VARY DEPENDING ON DIODE MATRIX ARRANGEMENT
TB102
+18V DC
FORWARD
REVERSE
SPEED 2
SPEED 3
SPEED 4
SPEED 5
+3.9VDC
BRIDGE
TB103
+18 VDC
FORWARD
REVERSE
SPEED 2
SPEED 3
SPEED 4
SPEED 5
+3.9 VDC
TROLLEY
CFA6
LO-
FIL
CFA6
HI-
FIL
CLN
LIM
FILT
LC
CL
CL

NOTES:

1. ALL TONE FILTERS ARE WIRED TO THEIR RESPECTIVE TERMINALS IN THE SAME MANNER AS SHOWN FOR THE TONE "A" FILTER.
2. THE EXPANSION DECK PLUG (P1) CONNECTS TO J11. SYSTEMS WITHOUT AN EXPANSION DECK USE A CLN6132B JUMPER PLUG IN J11.
3. DASHED LINES INDICATE WIRING ON CIRCUIT BOARDS.
4. SEE MODEL CHART OF THE RECEIVER-DECODER SECTION.
5. ASO GATE BOARD LOCATED BEHIND TONE FILTER PANEL JUST LEFT OF J3.

CLN1004B
MODEL TABLE

MODEL	SUFFIX	DESCRIPTION
CLN6125B	1	FILTER MTG CH
CFA6000A		TONE A FILTER
CFA6001A		TONE B FILTER
CFA6002A		TONE C FILTER
CFA6003A		TONE D FILTER
CFA6004A		TONE E FILTER
CFA6005A		TONE F FILTER
CFA6006A		TONE G FILTER
CFA6007A		TONE H FILTER
CFA6008A		TONE J FILTER
CFA6009A		TONE K FILTER
CFA6010A		TONE L FILTER
CFA6011A		TONE M FILTER
CFA6012A		TONE N FILTER
CFA6013A		TONE P FILTER
CFA6014A		TONE R FILTER
CFA6015A		TONE S FILTER
CFA6016A		TONE T FILTER
CFA6017A		TONE U FILTER

EPD-12332-D

PARTS LIST SHOWN ON
BACK OF THIS DIAGRAM

Receiver Decoder Unit
Intercabling Diagram
Motorola No. 63E81050A24-C
1/8/70-RS

J1, FILTER DRIVER

PIN NO.	FUNCTION	COLOR	A.W.G. NO.	WIRE	
				COMES FROM	GOES TO
[illegible]	B+	RED	[illegible]	[illegible]	[illegible]
B	GND	[illegible]	18		[illegible]
L	LOW LIMITER	[illegible]	24		[illegible]
P	HIGH LIMITER	[illegible]	24		[illegible]
R	AUDIO	[illegible]	24	J2-1	[illegible]

J2, RECEIVER

PIN NO.	FUNCTION	COLOR	A.W.G. NO.	WIRE	
				COMES FROM	GOES TO
1	AUDIO		24		J1-R
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	
[illegible]	GND	[illegible]	[illegible]		TB1-[illegible]
[illegible]	B+	[illegible]	[illegible]	[illegible]	[illegible]

J3, TEST

PIN NO.	FUNCTION	COLOR	A.W.G. NO.	WIRE	
				COMES FROM	GOES TO
A	B+	[illegible]	20	J[illegible]-C	J4-A
B	GND	[illegible]	18		TB1-5
D	ADDRESS MONOSTABLE [illegible]	[illegible]	24	J5-W	
E	ADDRESS GATE [illegible]	WHT-BLK	24		J5-N
F	START GATE [illegible]	BRN-RED	24		J5-D
H					
J	SEQUENCE VERIFIER ENABLE	WHT-BLU	24		J5-P
K	TIME SLOT 4	BRN-YEL	24	J10-E	
L	TIME SLOT 5	[illegible]	24	J10-F	
M	TIME SLOT 6	[illegible]	24	J10-H	J15-a
N	TIME SLOT 7	[illegible]	24	J10-J	
P	TIME SLOT 8	[illegible]	24	J10-K	
R	LOW GROUP CHECK (TEST ONLY)	[illegible]	24	J7-T	
S	HIGH GROUP CHECK (TEST ONLY)	WHT-GRN	24	J8-T	
U	CODE CHECK	BLK-WHT	24	J5-S	
V	TIME SLOT 1	WHT-BRN	24	J10-M	
W	START STOP BISTABLE	WHT-RED	24	J10-R	
Z	LOW GROUP TEST	WHT-YEL	24	J7-V	J4-Z
a	HIGH GROUP TEST	BLK-BRN	24	J8-V	J4-a
b	HIGH LIMITER	[illegible]	24	J1-P	J4-b
c	LOW LIMITER	[illegible]	24	J1-L	J4-c
d	AUDIO	[illegible]	24	J1-R	J4-d

J4, TEST

PIN NO.	FUNCTION	COLOR	A.W.G. NO.	WIRE	
				COMES FROM	GOES TO
A	B+	RED	20	J3-A	ASO GATE BOARD
B	GND	BLK	18		TB1-4
D	TONE A	RED-BLK	24	J7-D	J11-X
E	TONE B	RED-BRN	24	J7-E	J11-V
F	TONE C	RED-ORG	24	J9-X	J15-T
H	TONE D	RED-YEL	24	J7-H	J15-U
J	TONE E	RED-GRN	24	J7-J	J15-V
K	TONE F	RED-BLU	24	J7-K	J5-T
L	TONE G	RED-WHT	24	J7-L	J5-U
M	TONE H	YEL-BLK	24	J9-D	J11-D
N	TONE J	YEL-BRN	24	J9-E	J11-E
P	TONE K	YEL-RED	24	J9-F	J11-F
R	TONE L	YEL-GRN	24	J9-H	J11-H
S	TONE M	YEL-BLU	24	J9-J	J6-4
T	TONE N	GRN-BLK	24	J9-K	J6-5
U	TONE P	GRN-BRN	24	J9-L	J6-6
V	TONE R	GRN-RED	24	J9-M	J6-7
W	TONE S	GRN-ORG	24	J9-N	J6-8
X	TONE T	GRN-YEL	24	J9-P	J6-9
Y	TONE U	GRN-WHT	24	J8-R	
Z	LOW GROUP TEST	WHT-YEL	24	J3-Z	
a	HIGH GROUP TEST	BLK-BRN	24	J3-a	
b	HIGH LIMITER	YEL	24	J3-b	J8-U
c	LOW LIMITER	ORG	24	J3-c	J7-U
d	AUDIO	GRN	24	J3-d	

J5, ADDRESS VERIFIER

PIN NO.	FUNCTION	COLOR	A.W.G. NO.	WIRE	
				COMES FROM	GOES TO
A ‡	B+	RED	20		J10-C
B	GND	BLK	18		TB1-6
C ‡	B+	RED	20	J8-C	
D	TIME SLOT 3	BRN-RED	24	J3-F	J10-D
E *	ADDRESS TONE 3A	GRAY-RED	24		J6-11
F *	ADDRESS TONE 3B	GRAY-GRN	24		J6-12
H	ADDRESS TONE 1	BLU-RED	24		J6-1
J	ADDRESS TONE 2	BLU-YEL	24		J6-2
K	ADDRESS TONE 3	BLU-WHT	24		J6-3
L *	AUX 1	GRAY-WHT	24		J14-T
M	PUSH-TO-OPERATE RELAY	WHT	20		TB104-7
N	SEQUENCE VERIFIER SYNC	WHT-BLK	24	J3-E	J10-N
P	SEQUENCE VERIFIER ENABLE	WHT-BLU	24	J3-J	J10-P
R *	OPERATOR RELEASE AUXILIARY	BLU-GRN	24		TB-104-8
S	CODE CHECK INPUT	BLK-WHT	24	J8-S	J3-U
T	TONE F	RED-BLU	24	J4-K	J11-R
U	TONE G	RED-WHT	24	J4-L	J11-S
W	ADDRESS MONOSTABLE TEST	BLK-RED	24		J3-D
X	OPR B RELAY	WHT-RED	20		TB104-2
V	OPR A RELAY	WHT-BRN	20		TB104-1

*NOTE: USED FOR MULTIPLE TRANSMITTER OPERATION ONLY.
‡NOTE: THE WIRES ON PINS A AND C MAY BE INTERCHANGED.

J6, ADDRESS PLUG RECEPTACLE

PIN NO.	FUNCTION	COLOR	A.W.G. NO.	WIRE	
				COMES FROM	GOES TO
1	ADDRESS TONE 1	BLU-RED	24	J5-H	J14-H
2	ADDRESS TONE 2	BLU-YEL	24	J5-J	J14-J
3	ADDRESS TONE 3	BLU-WHT	24	J5-K	J14-K OR F
4	TONE M	YEL-BLU	24	J4-S	J11-J
5	TONE N	GRN-BLK	24	J4-T	J11-K
6	TONE P	GRN-BRN	24	J4-U	J11-L
7	TONE R	GRN-RED	24	J4-V	J11-M
8	TONE S	GRN-ORG	24	J4-W	J11-N
9	TONE T	GRN-YEL	24	J4-X	J11-P
11	ADDRESS TONE 3A	GRAY-RED	24	J5-E	
12	ADDRESS TONE 3B	GRAY-GRN	24	J5-F	
14					

J7, LOW TONE DECODER

PIN NO.	FUNCTION	COLOR	A.W.G. NO.	WIRE	
				COMES FROM	GOES TO
A ‡	B+	RED	20	J2-6	
B	GND	BLK	18		TB2-2
C ‡	B+	RED	20		J8-A
D	TONE A	RED-BLK	24		J4-D
E	TONE B	RED-BRN	24		J4-E
F	TONE C	RED-ORG	24		J9-X
H	TONE D	RED-YEL	24		J4-H
J	TONE E	RED-GRN	24		J4-J
K	TONE F	RED-BLU	24		J4-K
L	TONE G	RED-WHT	24		J4-L
N	KEY	---	--		
T	LOW GROUP CHECK (TEST ONLY)	WHT-ORG	24		J3-R
U	LOW LIMITER	ORG	24	J4-c	
V	LOW TONE DECODER TEST INPUT	WHT-YEL	24		J3-Z
X	LOW GROUP CHECK OUTPUT	WHT-BLK-RED	24		J8-X

J8, HIGH TONE DECODER

PIN NO.	FUNCTION	COLOR	A.W.G. NO.	WIRE	
				COMES FROM	GOES TO
A ‡	B+	RED	20	J7-C	
B	GND	BLK	18		TB2-1
C ‡	B+	RED	20		J5-C
D	TONE H	YEL-BLK	24		J9-D
E	TONE J	YEL-BRN	24		J9-E
F	TONE K	YEL-RED	24		J9-F
H	TONE L	YEL-GRN	24		J9-H
J	TONE M	YEL-BLU	24		J9-J
K	TONE N	GRN-BLK	24		J9-K
L	TONE P	GRN-BRN	24		J9-L
M	TONE R	GRN-RED	24		J9-M
N	TONE S	GRN-ORG	24		J9-N
P	TONE T	GRN-YEL	24		J9-P
R	TONE U	GRN-WHT	24		J4-Y
S	CODE CHECK	BLK-WHT	24		J5-S
T	HIGH GROUP CHECK (TEST ONLY)	WHT-GRN	24		J3-S
U	HIGH LIMITER	YEL	24	J4-b	
V	HIGH TONE DECODER TEST INPUT	BLK-BRN	24		J3-a
W	KEY	---	--		
X	LOW GROUP CHECK INPUT	WHT-BLK-RED	24	J7-X	

J9, MOTOR FUNCTION DECODER (HOIST)

PIN NO.	FUNCTION	COLOR	A.W.G. NO.	WIRE	
				COMES FROM	GOES TO
A ‡	B+	RED	20	J10-A	
B	GND	BLK	18		TB1-8
C ‡	B+	RED	20		J12-A
D	TONE H	YEL-BLK	24	J8-D	J4-M
E	TONE J	YEL-BRN	24	J8-E	J4-N
F	TONE K	YEL-RED	24	J8-F	J4-P
H	TONE L	YEL-GRN	24	J8-H	J4-R
J	TONE M	YEL-BLU	24	J8-J	J4-S
K	TONE N	GRN-BLK	24	J8-K	J4-T
L	TONE P	GRN-BRN	24	J8-L	J4-U
M	TONE R	GRN-RED	24	J8-M	J4-V
N	TONE S	GRN-ORG	24	J8-N	J4-W
P	TONE T	GRN-YEL	24	J8-P	J4-X
U	KEY	---	--		
W	TIME SLOT 6	BRN-BLU	24		J10-H
X	TONE C	RED-ORG	24	J7-F	J4-F

J10, SEQUENCE VERIFIER

PIN NO.	FUNCTION	COLOR	A.W.G. NO.	WIRE	
				COMES FROM	GOES TO
A ‡	B+	RED	20		J9-A
B	GND	BLK	18		TB1-7
C ‡	B+	RED	20	J5-A	
D	TIME SLOT 3	BRN-RED	24	J5-D	
E	TIME SLOT 4	BRN-YEL	24	J15-Y	J3-K
F	TIME SLOT 5	BRN-GRN	24	J15-Z	J3-L
H	TIME SLOT 6	BRN-BLU	24	J9-W	J3-M
J	TIME SLOT 7	BRN-GRAY	24	J11-W	J3-N
K	TIME SLOT 8	BRN-WHT	24	J11-T	J3-P
M	TIME SLOT 1	WHT-BRN	24		J3-V
N	SYNC INPUT	WHT-BLK	24	J5-N	J14-R
P	ENABLE INPUT	WHT-BLU	24	J5-P	J14-W
R	START STOP BISTABLE OUTPUT	WHT-RED	24		J3-W
L	KEY				

J11, EXPANSION DECK

PIN NO.	FUNCTION	COLOR	A.W.G. NO.	WIRE	
				COMES FROM	GOES TO
A ‡	B+	RED	20	J14-C	
B	GND	BLK	18		TB2-3
C ‡	B+	RED	20		J15-A
D	TONE H	YEL-BLK	24	J4-M	J15-D
E	TONE J	YEL-BRN	24	J4-N	J15-E
F	TONE K	YEL-RED	24	J4-P	J15-F
H	TONE L	YEL-GRN	24	J4-R	J15-H
J	TONE M	YEL-BLU	24	J6-4	J15-J
K	TONE N	GRN-BLK	24	J6-5	J15-K
L	TONE P	GRN-BRN	24	J6-6	J15-L
M	TONE R	GRN-RED	24	J6-7	J15-M
N	TONE S	GRN-ORG	24	J6-8	J15-N
P	TONE T	GRN-YEL	24	J6-9	J15-P
R	TONE F	RED-BLU	24	J5-T	J15-W
S	TONE G	RED-WHT	24	J5-U	J15-X
T	TIME SLOT 8	BRN-WHT	24	J15-c	J10-K
V	TONE B	RED-BRN	24	J4-E	J15-S
W	TIME SLOT 7	BRN-GRAY	24	J15-b	J10-J
X	TONE A	RED-BLK	24	J4-D	J15-R
L	KEY				

J12, MOTOR FUNCTION DECODER (TROLLEY)

PIN NO.	FUNCTION	COLOR	A.W.G. NO.	WIRE	
				COMES FROM	GOES TO
A ‡	B+	RED	20	J9-C	
B	GND	BLK	18		TB2-6
C ‡	B+	RED	20		J13-A
D	TONE H	YEL-BLK	24	J13-D	
E	TONE J	YEL-BRN	24	J13-E	
F	TONE K	YEL-RED	24	J13-F	
H	TONE L	YEL-GRN	24	J13-H	
J	TONE M	YEL-BLU	24	J13-J	
K	TONE N	GRN-BLK	24	J13-K	
L	TONE P	GRN-BRN	24	J13-L	
M	TONE R	GRN-RED	24	J13-M	
N	TONE S	GRN-ORG	24	J13-N	
P	TONE T	GRN-YEL	24	J13-P	
U	KEY	---	--		
W	TIME SLOT 5	BRN-GRN	24		J15-W
X	TONE D	RED-YEL	24	J15-U	

J13, MOTOR FUNCTION DECODER (BRIDGE)

PIN NO.	FUNCTION	COLOR	A.W.G. NO.	WIRE	
				COMES FROM	GOES TO
A ‡	B+	RED	20	J12-C	
B	GND	BLK	18		TB2-5
C ‡	B+	RED	20		J14-A
D	TONE H	YEL-BLK	24	J14-D	J12-D
E	TONE J	YEL-BRN	24	J14-E	J12-E
F	TONE K	YEL-RED	24	J14-F OR K	J12-F
H	TONE L	YEL-GRN	24	J15-H	J12-H
J	TONE M	YEL-BLU	24	J15-J	J12-J
K	TONE N	GRN-BLK	24	J15-K	J12-K
L	TONE P	GRN-BRN	24	J15-L	J12-L
M	TONE R	GRN-RED	24	J15-M	J12-M
N	TONE S	GRN-ORG	24	J15-N	J12-N
P	TONE T	GRN-YEL	24	J15-P	J12-P
U	KEY	---	--		
W	TIME SLOT 4	BRN-YEL	24		J15-Y
X	TONE E	RED-GRN	24	J15-V	

J14, AUXILIARY FUNCTION DECODER

PIN NO.	FUNCTION	COLOR	A.W.G. NO.	WIRE	
				COMES FROM	GOES TO
A ‡	B+	RED	20	J13-C	
B	GND	BLK	18		TB2-4
C ‡	B+	RED	20		J11-A
D	TONE H	YEL-BLK	24	J15-D	J13-D
F	TONE J	YEL-BRN	24	J15-E	J13-E
L	TONE A	RED-BLK	24	J15-R	
M	TONE F	RED-BLU	24	J15-W	
P	KEY				
U	TIME SLOT 8	BRN-WHT	24	J14-N or S	J15-c
W	ENABLE	WHT-BLU	24	J10-P	J14-S or N
X	TONE G	RED-WHT	24	J15-X	

THE FOLLOWING ARE DEPENDENT ON OPTION USED

OPTION A	OPTION B	OPTION C	FUNCTION	COLOR	A.W.G. NO.	WIRE	
						COMES FROM	GOES TO
F	K	F	TONE K	YEL-RED	24	J15-F	J13-F
K	F	K	ADDRESS TONE 3	BLU-WHT	24	J6-3	
N	S	N	TIME SLOT 8	BRN-WHT	24		J14-U
S	N	V	ENABLE	WHT-BLU	24	J14-W	
V	V	S	GND	BLK	24		TB2-4

THE FOLLOWING ARE DEPENDENT ON MODEL

MODELS C1120B, C C1121B, C	MODELS C1124A, B C1125A, B	FUNCTION	COLOR	A.W.G. NO.	COMES FROM	GOES TO
H	T	ADDRESS TONE 1	BLU-RED	24	J6-1	
T	H	AUX 1	GRY-WHT	24	J5-L	
J	R	ADDRESS TONE 2	BLU-YEL	24	J6-2	
R	J	AUX 2	WHT-BLK	24	J10-N	

J15, AUTOMATIC SAFETY OVERRIDE CIRCUIT

PIN NO.	FUNCTION	COLOR	A.W.G. NO.	WIRE	
				COMES FROM	GOES TO
A ‡	B+	RED	20	J11-C	
B	GND	BLK	18	TB1-1	
C ‡	B+	RED	20		J14-A
D	TONE H	YEL-BLK	24	J11-D	J14-D
E	TONE J	YEL-BRN	24	J11-E	J14-F
F	TONE K	YEL-RED	24	J11-F	J14-F or K
H	TONE L	YEL-GRN	24	J11-H	J13-H
J	TONE M	YEL-BLU	24	J11-J	J13-J
K	TONE N	GRN-BLK	24	J11-K	J13-K
L	TONE P	GRN-BRN	24	J11-L	J13-L
M	TONE R	GRN-RED	24	J11-M	J13-M
N	TONE S	GRN-ORG	24	J11-N	J13-N
P	TONE T	GRN-YEL	24	J11-P	J13-P
R	TONE A	RED-BLK	24	J11-X	J14-L
S	TONE B	RED-BRN	24	J11-V	
T	TONE C	RED-ORG	24	J4-F	
U	TONE D	RED-YEL	24	J4-H	J12-X
V	TONE E	RED-GRN	24	J4-J	J13-X
W	TONE F	RED-BLU	24	J11-R	J14-M
X	TONE G	RED-WHT	24	J11-S	J14-X
Y	TIME SLOT 4	BRN-YEL	24	J13-W	J10-E
Z	TIME SLOT 5	BRN-GRN	24	J12-W	J10-F
a	TIME SLOT 6	BRN-BLU	24	J3-M	
b	TIME SLOT 7	BRN-GRAY	24		J11-W
c	TIME SLOT 8	BRN-WHT	24	J14-U	J11-T
d	ERROR OUTPUT	WHT-BLK-RED	24		ASO GATE BD.

TB1

TERM. NO.	FUNCTION	COLOR	A.W.G. NO.	WIRE	
				COMES FROM	GOES TO
1	GND	BLK	18	TB104-5	
2	GND	BLK	18	J1-B	
3	GND	BLK	18	J2-B	
4	GND	BLK	18	J4-B	
5	GND	BLK	18	J3-B	
6	GND	BLK	18	J5-B	
7	GND	BLK	18	J10-B	
8	GND	BLK	18	J9-B	

NOTE:

ALL TERMINALS ON TB1 & TB2 ARE JUMPED TOGETHER BY BARE [illegible] WIRE.

TB2

TERM. NO.	FUNCTION	COLOR	A.W.G. NO.	WIRE	
				COMES FROM	GOES TO
1	GND	BLK	18	J8-B	
2	GND	BLK	18	J7-B	
3	GND	BLK	18	J11-B	
4	GND	BLK	18	J14-V	J14-B
5	GND	BLK	18	J13-B	
6	GND	BLK	18	J12-B	
7	GND				
8	GND				

TB104

TERM. NO.	FUNCTION	COLOR	A.W.G. NO.	WIRE	
				COMES FROM	GOES TO
1	OPR A RELAY	WHT-BRN	20	J5-V	[illegible]
2	OPR B RELAY	WHT-RED	20	J5-X	[illegible]
4	+14 VDC	RED	20	C1-1	[illegible]
5	GND	BLK	[illegible]	C1-2	TB1-1
6	GATED B+ TO RELAY	BRN	[illegible]	ASO GATE BOARD	
7	PUSH-TO-OPERATE RELAY	WHT	20	J5-M	
8	OPERATOR RELEASE	BLU-GRN	24	J5-R	

NOTE: TB7 IS A FANNING STRIP USED TO TERMINATE WIRES TO TB104 ON RECEIVER DECODER CABINET.

[illegible] JUMPER PLUG

P1, JUMPER PLUG

PIN NO.	FUNCTION	COLOR	A.W.G. NO.	WIRE	
				COMES FROM	GOES TO
A	B+	RED	20		P1-[illegible]
C	B+	RED	[illegible]	P1-[illegible]	

PART OF [illegible] EXPANSION DECK

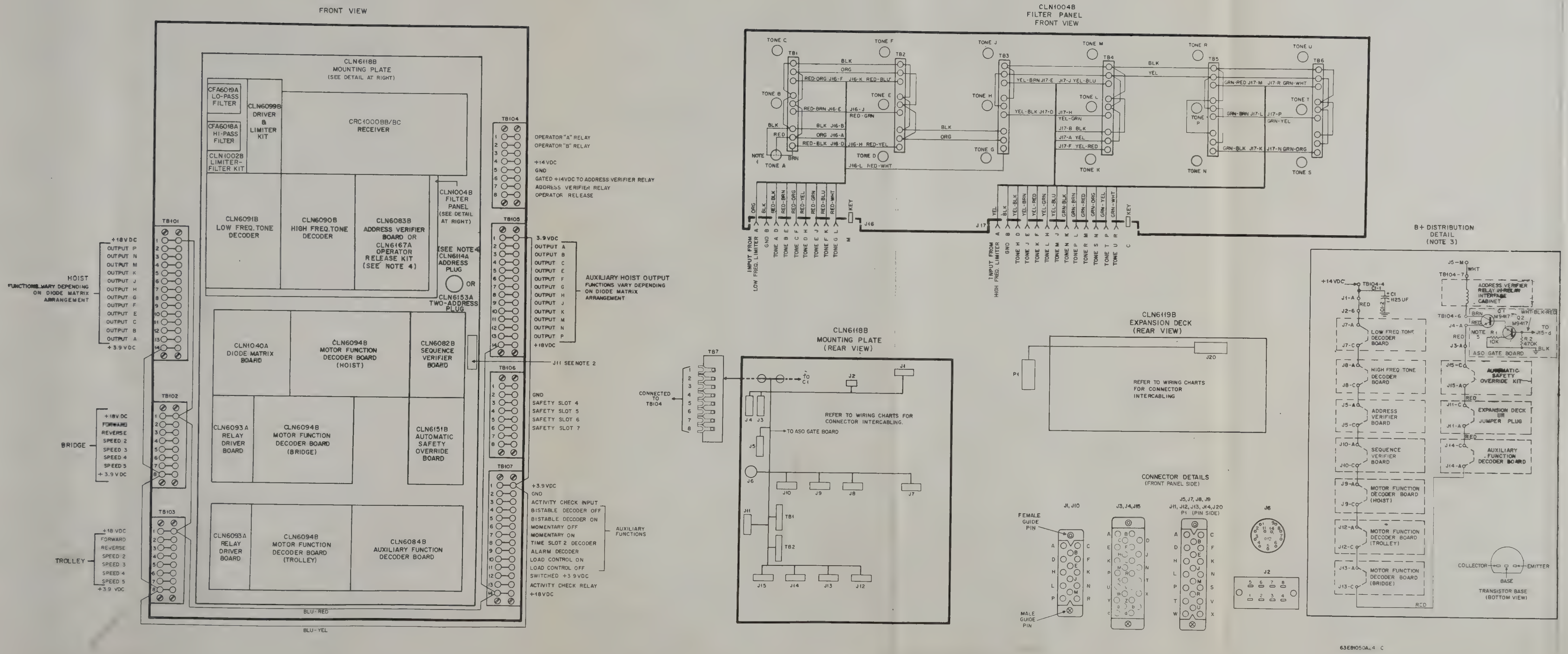
[illegible], MOTOR FUNCTION DECODER AUXILIARY

PIN NO.	FUNCTION	COLOR	A.W.G. NO.	WIRE	
				COMES FROM	GOES TO
A ‡	B+	RED	20	P1-[illegible]	
B	GND	BLK	[illegible]	P1-[illegible]	
C ‡	B+	RED	20	P1-[illegible]	
D	TONE H	YEL-BLK	24	P1-[illegible]	
E	TONE J	YEL-BRN	24	P1-[illegible]	
F	TONE K	YEL-RED	24	P1-[illegible]	
H	TONE L	YEL-GRN	24	P1-[illegible]	
J	TONE M	YEL-BLU	24	P1-[illegible]	
K	TONE N	GRN-BLK	24	P1-[illegible]	
L	TONE P	GRN-BRN	24	P1-[illegible]	
M	TONE R	GRN-RED	24	P1-[illegible]	
N	TONE S	GRN-ORG	24	P1-[illegible]	
P	TONE T	GRN-YEL	24	P1-[illegible]	
W	TIME SLOT [illegible]	BRN-GRAY	24	P1-[illegible]	
X	TONE B	RED-BRN	24	P1-[illegible]	

PART OF [illegible] EXPANSION DECK

P1, EXPANSION DECK

PIN NO.	FUNCTION	COLOR	A.W.G. NO.	WIRE	
				COMES FROM	GOES TO
A ‡	B+	RED	[illegible]		[illegible]-A
B	GND	BLK	[illegible]		[illegible]
C ‡	B+	RED	[illegible]		[illegible]
D	TONE H	YEL-BLK	24		[illegible]
E	TONE J	YEL-BRN	24		[illegible]
F	TONE K	YEL-RED	24		[illegible]
H	TONE L	YEL-GRN	24		[illegible]
J	TONE M	YEL-BLU	24		[illegible]
K	TONE N	GRN-BLK	24		[illegible]-K
L	TONE P	GRN-BRN	24		[illegible]-L
M	TONE R	GRN-RED	24		[illegible]-M
N	TONE S	GRN-ORG	24		[illegible]
P	TONE T	GRN-YEL	24		[illegible]-P
V	TONE B	RED-BRN	24		[illegible]
W	TIME SLOT [illegible]	BRN-GRY	24		[illegible]-W


FRONT VIEW
CLN6118B MOUNTING PLATE (SEE DETAIL AT RIGHT)
CFA6019A LO-PASS FILTER
CFA6018A HI-PASS FILTER
CLN1002B LIMITER-FILTER KIT
CLN6099B DRIVER & LIMITER KIT
CRC1000BB/BC RECEIVER
CLN1004B FILTER PANEL (SEE DETAIL AT RIGHT)
CLN6091B LOW FREQ. TONE DECODER
CLN6090B HIGH FREQ. TONE DECODER
CLN6083B ADDRESS VERIFIER BOARD OR CLN6167A OPERATOR RELEASE KIT (SEE NOTE 4)
(SEE NOTE 4) CLN6114A ADDRESS PLUG OR CLN6153A TWO-ADDRESS PLUG
CLN1040A DIODE MATRIX BOARD
CLN6094B MOTOR FUNCTION DECODER BOARD (HOIST)
CLN6082B SEQUENCE VERIFIER BOARD
J11 SEE NOTE 2
CLN6093A RELAY DRIVER BOARD
CLN6094B MOTOR FUNCTION DECODER BOARD (BRIDGE)
CLN6151B AUTOMATIC SAFETY OVERRIDE BOARD
CLN6093A RELAY DRIVER BOARD
CLN6094B MOTOR FUNCTION DECODER BOARD (TROLLEY)
CLN6084B AUXILIARY FUNCTION DECODER BOARD
BLU-RED
BLU-YEL
TB101
HOIST
FUNCTIONS VARY DEPENDING ON DIODE MATRIX ARRANGEMENT
+18VDC
OUTPUT P
OUTPUT N
OUTPUT M
OUTPUT K
OUTPUT J
OUTPUT H
OUTPUT G
OUTPUT F
OUTPUT E
OUTPUT C
OUTPUT B
OUTPUT A
+3.9VDC
TB102
BRIDGE
+18VDC
FORWARD
REVERSE
SPEED 2
SPEED 3
SPEED 4
SPEED 5
+3.9VDC
TB103
TROLLEY
+18 VDC
FORWARD
REVERSE
SPEED 2
SPEED 3
SPEED 4
SPEED 5
+3.9 VDC
TB104
OPERATOR "A" RELAY
OPERATOR "B" RELAY
+14VDC
GND
GATED +14VDC TO ADDRESS VERIFIER RELAY
ADDRESS VERIFIER RELAY
OPERATOR RELEASE
TB105
3.9VDC
OUTPUT A
OUTPUT B
OUTPUT C
OUTPUT E
OUTPUT F
OUTPUT G
OUTPUT H
OUTPUT J
OUTPUT K
OUTPUT M
OUTPUT N
OUTPUT P
+18VDC
AUXILIARY HOIST OUTPUT
FUNCTIONS VARY DEPENDING ON DIODE MATRIX ARRANGEMENT
TB106
GND
SAFETY SLOT 4
SAFETY SLOT 5
SAFETY SLOT 6
SAFETY SLOT 7
TB107
+3.9VDC
GND
ACTIVITY CHECK INPUT
BISTABLE DECODER OFF
BISTABLE DECODER ON
MOMENTARY OFF
MOMENTARY ON
TIME SLOT 2 DECODER
ALARM DECODER
LOAD CONTROL ON
LOAD CONTROL OFF
SWITCHED +3.9VDC
ACTIVITY CHECK RELAY
+18VDC
AUXILIARY FUNCTIONS
CLN1004B FILTER PANEL FRONT VIEW
TONE A
TONE B
TONE C
TONE D
TONE E
TONE F
TONE G
TONE H
TONE J
TONE K
TONE L
TONE M
TONE N
TONE P
TONE R
TONE S
TONE T
TONE U
NOTE 1
TB1
TB2
TB3
TB4
TB5
TB6
BLK
ORG
RED
BRN
YEL
RED-ORG J16-F
J16-K RED-BLU
RED-BRN J16-E
J16-J RED-GRN
BLK J16-B
ORG J16-A
RED-BLK J16-D
J16-H RED-YEL
J16-L RED-WHT
YEL-BRN J17-E
J17-J YEL-BLU
YEL-BLK J17-D
J17-H YEL-GRN
J17-B BLK
J17-A YEL
J17-F YEL-RED
GRN-RED J17-M
J17-R GRN-WHT
GRN-BRN J17-L
J17-P GRN-YEL
GRN-BLK J17-K
J17-N GRN-ORG
J16
KEY
INPUT FROM LOW FREQ. LIMITER
GND
J17
INPUT FROM HIGH FREQ. LIMITER
CLN6118B MOUNTING PLATE (REAR VIEW)
TB7
CONNECTED TO TB104
TO C1
TO ASO GATE BOARD
REFER TO WIRING CHARTS FOR CONNECTOR INTERCABLING.
J1
J2
J3
J4
J5
J6
J7
J8
J9
J10
J11
J12
J13
J14
J15
TB1
TB2
CLN6119B EXPANSION DECK (REAR VIEW)
P1
J20
REFER TO WIRING CHARTS FOR CONNECTOR INTERCABLING
CONNECTOR DETAILS (FRONT PANEL SIDE)
J1, J10
J3, J4, J15
J5, J7, J8, J9 J11, J12, J13, J14, J20 P1 (PIN SIDE)
J6
J2
FEMALE GUIDE PIN
MALE GUIDE PIN
B+ DISTRIBUTION DETAIL (NOTE 3)
+14VDC
TB104-4
C1
1125 UF
J1-A
J2-6
RED
LOW FREQ TONE DECODER BOARD
HIGH FREQ TONE DECODER BOARD
ADDRESS VERIFIER BOARD
SEQUENCE VERIFIER BOARD
MOTOR FUNCTION DECODER BOARD (HOIST)
MOTOR FUNCTION DECODER BOARD (TROLLEY)
MOTOR FUNCTION DECODER BOARD (BRIDGE)
J5-M
WHT
TB104-7
ADDRESS VERIFIER RELAY IN RELAY INTERFACE CABINET
TB104-6
BRN
Q1 M9417
Q2 M9417
WHT-BLK-RED
TO J15-d
NOTE 5
R1 10K
R2 470K
BLK
J4-A
J3-A
ASO GATE BOARD
AUTOMATIC SAFETY OVERRIDE KIT
EXPANSION DECK OR JUMPER PLUG
AUXILIARY FUNCTION DECODER BOARD
COLLECTOR
EMITTER
BASE
TRANSISTOR BASE (BOTTOM VIEW)
63E81050A24 C

NOTES:

1. ALL TONE FILTERS ARE WIRED TO THEIR RESPECTIVE TERMINALS IN THE SAME MANNER AS SHOWN FOR THE TONE "A" FILTER.
2. THE EXPANSION DECK PLUG (P1) CONNECTS TO J11 SYSTEMS WITHOUT AN EXPANSION DECK USE A CLN6132B JUMPER PLUG IN J11
3. DASHED LINES INDICATE WIRING ON CIRCUIT BOARDS
4. SEE MODEL CHART OF THE RECEIVER-DECODER SECTION
5. ASO GATE BOARD LOCATED BEHIND TONE FILTER PANEL JUST LEFT OF [illegible]

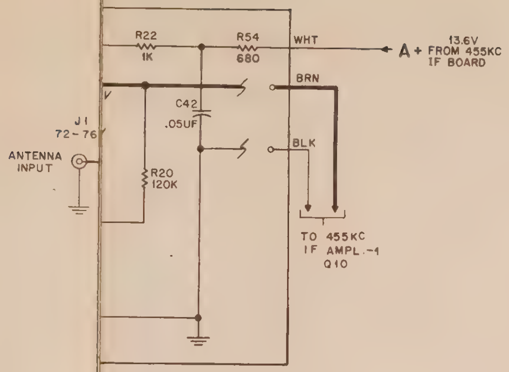
CLN1004B
MODEL TABLE

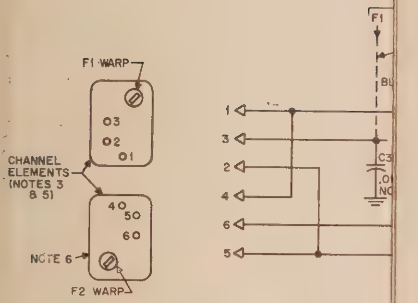
MODEL	SUFFIX	DESCRIPTION
[illegible]		[illegible]
[illegible]		[illegible]
[illegible]		[illegible]
[illegible]		[illegible]
[illegible]		[illegible]
[illegible]		[illegible]
[illegible]		[illegible]
CFA6006A		[illegible]
[illegible]		[illegible]
[illegible]		[illegible]
[illegible]		[illegible]
[illegible]		[illegible]
[illegible]		[illegible]
[illegible]		[illegible]
[illegible]		[illegible]
[illegible]		[illegible]
[illegible]		[illegible]
[illegible]		[illegible]
[illegible]		[illegible]

EPD-12332-D

PARTS LIST SHOWN ON
BACK OF THIS DIAGRAM

Receiver Decoder Unit
Intercabling Diagram
Motorola No. 63E81050A24-C
1/8/70-RS


R22
1K
R54
680
WHT
A+
13.6V
FROM 455KC
IF BOARD
BRN
C42
.05UF
J1
72-76
ANTENNA
INPUT
R20
120K
BLK
TO 455KC
IF AMPL.-1
Q10


F1
F1 WARP
03
02
01
CHANNEL
ELEMENTS
(NOTES 3
& 5)
40
50
60
NOTE 6
F2 WARP
1
3
2
4
6
5

NOTES:

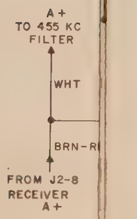
1. UNLESS OTHERWISE STATED:
   CAPACITOR VALUES ARE IN MICROMICROFARADS.
   RESISTOR VALUES ARE IN OHMS; K=1000.
2. ALL DC VOLTAGE READINGS ARE REFERENCED TO CHASSIS AND ARE MEASURED WITH A 20K OHM PER VOLT MULTIMETER, EXCEPT WHERE OTHERWISE STATED.
3. PIN NUMBERS ARE FOR REFERENCE ONLY. PINS ARE PART OF CIRCUIT BOARD.
4. COMPONENT REFERENCES OUTLINED BY A RECTANGLE INDICATE SCREENING ON THE RECEIVER.
5. FREQUENCY CALCULATION: $f_{01} = \frac{f_c + 8\text{ MC}}{6}$ (72-76 MC)
6. USED IN 2-FREQ. (F2) MODELS ONLY.
7. JUMPER JU1 IS USED IN 1-FREQ. (F1) MODELS ONLY.

MODEL TABLE

MODEL	SUFFIX	DESCRIPTION
CLN6207A		RECEIVER CHASSIS
TLC6000A		RF DECK
TLN6733BS		455 KC IF BOARD
CLN6205A		MULTIPLIER
CLN6206A*		AUTOMATIC FREQ. SELECT KIT
TLN8213A		8 MC IF & 2ND OSCILLATOR
TLN8013A		CABLE & SOCKET KIT
TFN6017CS		455 KC FILTER
TLN1081A		CHANNEL ELEMENT
G09		IF CRYSTAL

*USED IN CRC1000BC ONLY

EPD-21283-A


A+
TO 455 KC
FILTER
WHT
BRN-R
FROM J2-8
RECEIVER
A+

PREVIOUS REVISIONS AND PARTS LIST
SHOWN ON BACK OF THIS DIAGRAM

72-76 MC Receiver
Schematic Diagram
Motorola No. 63E81056A11-01
8/28/68-RS

PARTS LIST

CLN6118B Mounting Chassis EPD-13996-A

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
		CAPACITOR, fixed:
C1	23D82394A02	1125 uf +250-10%; 20 v
		CONNECTOR, receptacle:
J1		c/o: 14A83102B04 INSULATOR 22A83103B01 PIN guide: male 22A83103B02 PIN, guide: female 9A04928A02 TERMINAL, cont.: female: coded YEL; 3 req'd 9A04928A03 TERMINAL, cont.: female: coded BLU; 2 req'd (terminals A, B)
J2 J3	9K864120	female; 8 cont. c/o: 14A83102B06 INSULATOR 22A83103B01 PIN, guide: male 22A83103B02 PIN, guide: female 9A04928A02 TERMINAL, cont.: female; coded YEL; 20 req'd 9A04928A03 TERMINAL, cont.: female: coded BLU; 2 req'd (terminals A, B)
J4		c/o: 14A83102B06 INSULATOR 22A83103B01 PIN, guide: male 22A83103B02 PIN, guide: female 9A04928A02 TERMINAL, cont.: female; coded YEL; 23 req'd 9A04928A03 TERMINAL, cont.: female: coded BLU; 2 req'd (terminals A, B)
J5		c/o: 14A83102B02 INSULATOR 22A83103B01 PIN, guide: male 22A83103B02 PIN, guide: female 9A04928A02 TERMINAL, cont.: female; coded YEL; 18 req'd 9A04928A03 TERMINAL, cont.: female: coded BLU; 1 req'd (terminal B)
J6 J7	9C857358	female; 12 cont. c/o: 14A83102B02 INSULATOR 22A83103B01 PIN, guide: male 22A83103B02 PIN, guide: female 9A04928A02 TERMINAL, cont.: female; coded YEL; 13 req'd 9A04928A03 TERMINAL, cont.: female; coded BLU; 1 req'd (terminal B)
J8		c/o: 14A83102B02 INSULATOR 22A83103B01 PIN, guide: male 22A83103B02 PIN, guide: female 9A04928A02 TERMINAL, cont.: female; coded YEL; 18 req'd 9A04928A03 TERMINAL, cont.: female, coded BLU; 1 req'd (terminal B)
J9		c/o: 14A83102B02 INSULATOR 22A83103B01 PIN, guide: male 22A83103B02 PIN, guide: female 9A04928A02 TERMINAL, cont.: female; coded YEL; 4 req'd 9A04928A03 TERMINAL, cont.: female; coded BLU; 1 req'd (terminal B)
J10		c/o: 14A83102B04 INSULATOR 22A83103B01 PIN, guide: male 22A83103B02 PIN, guide: female 9A04928A02 TERMINAL, cont.: female; coded YEL; 12 req'd 9A04928A03 TERMINAL, cont.: female; coded BLU; 1 req'd (terminal B)
J11		c/o: 14A83102B02 INSULATOR 22A83103B01 PIN, guide: male 22A83103B02 PIN, guide: female 9A04928A02 TERMINAL, cont.: female; coded YEL; 18 req'd 9A04928A03 TERMINAL, cont.: female; coded BLU; 1 req'd (terminal B)
J12		c/o: 14A83102B02 INSULATOR 22A83103B01 PIN, guide: male 22A83103B02 PIN, guide: female 9A04928A02 TERMINAL, cont.: female; coded YEL; 14 req'd 9A04928A03 TERMINAL, cont.: female; coded BLU; 1 req'd (terminal B)
J13		c/o: 14A83102B02 INSULATOR 22A83103B01 PIN, guide: male 22A83103B02 PIN, guide: female 9A04928A02 TERMINAL, cont.: female; coded YEL; 14 req'd 9A04928A03 TERMINAL, cont.: female; coded BLU; 1 req'd (terminal B)
J14		c/o: 14A83102B02 INSULATOR 22A83103B01 PIN, guide: male 22A83103B02 PIN, guide: female 9A04928A02 TERMINAL, cont.: female; coded YEL; 11 req'd 9A04928A03 TERMINAL, cont.: female; coded BLU; 1 req'd (terminal B)
J15		c/o: 14A83102B06 INSULATOR 22A83103B01 PIN, guide: male 22A83103B02 PIN, guide: female 9A04928B02 TERMINAL, cont.: female; coded YEL; 25 req'd 9A04928B03 TERMINAL, cont.: female; coded BLU; 1 req'd (terminal B)
		TRANSISTOR, P-N-P:
Q1, 2	48R869417	M9417
		TERMINAL BOARD:
TB1, 2	31S128069	8 solder lug terminals & 2 mounting lug terminals
TB7	31B83079B01	fanning strip; 8 cont.
		RESISTOR, fixed:
R1	6S129668	10K ±5%; 1/4 w
R2	6S129149	470K ±5%; 1/4 w
	NON-REFERENCED ITEM	
	1V807A96A92	ASO GATE BOARD ASSY., includes ref. parts Q1, Q2, R1 and R2

CLN6132B Jumper Plug (3-Deck) EPD-13997-O

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
	CLN6132A	CONNECTOR, plug: male; 20 cont.; incl.: 14A83102B01 BODY; 28A04932A03 TERMINAL, male; 16 req'd; 22A83103B03 PIN, polarizing: male; turnable female jackscrew, 3A83275D02

CLN6114A Address Plug EPD-12110-O

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
	CLN6114A	consists of a 9-contact male plug containing an internal jumpering arrangement. NOTE: When ordering a replacement plug, specify CLN6114A Address Plug and mention the code letters stamped on the plug

CLN6153A Address Plug Kit EPD-17914-O

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
	28B864669	CONNECTOR, plug: male; 12 contact
	15B82225G02	COVER, connector plug

CHN6012A Cabinet Kit EPD-12111-O

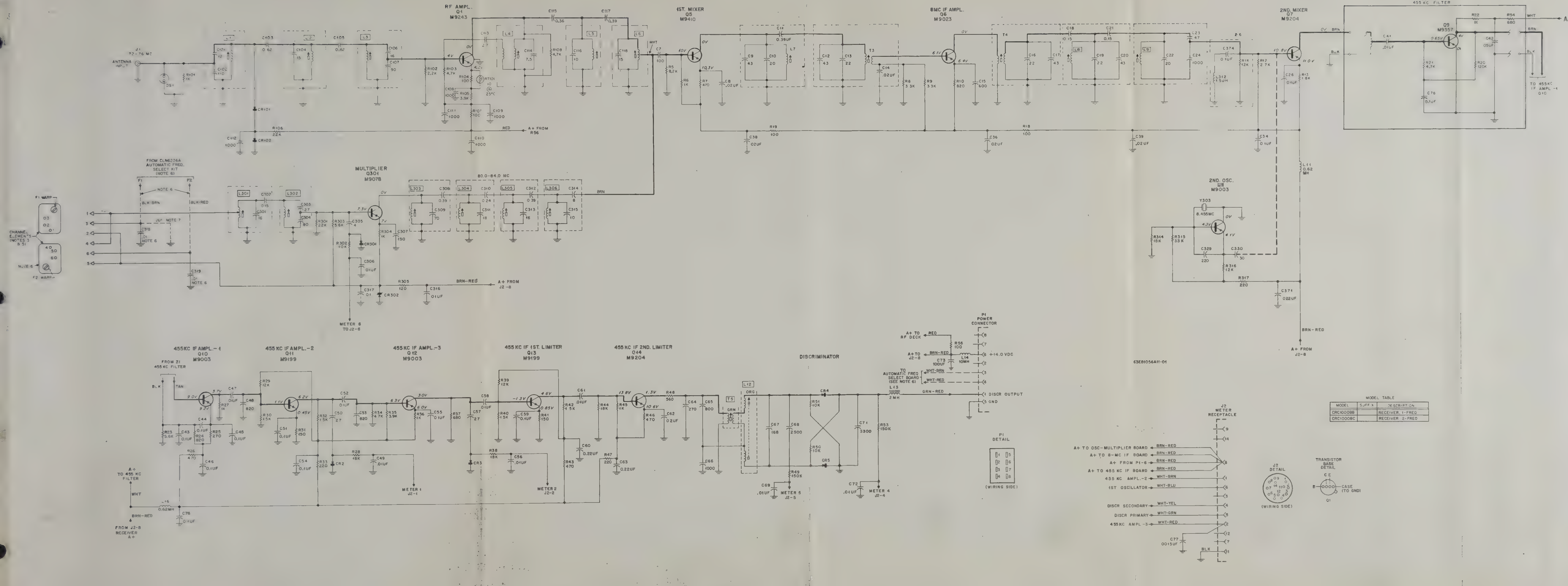
REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
		TERMINAL BOARD:
TB101	31K832894	14 dual screw terminals: does not include 13C82343C05 MARKER, terminal identification
TB102, 103	31K816278	8 dual screw terminals; does not include 13C82343C03 MARKER, terminal identification
TB104, 106	31K816278	8 dual screw terminals; does not include 13C82343C02 MARKER, terminal identification
TB105, 107	31K832894	14 dual screw terminals; does not include 13C82343C04 MARKER, terminal identification
	NON-REFERENCED ITEM	
	55B83616B01	LOCK, cabinet door: includes mounting hardware and two keys, part number 55K893872

CKN6013A Jumper Cable Kit EPD-12112-O

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
	1V80753A01	includes miscellaneous lugs and wires. Interconnects terminal boards in cabinet (BLU-RED and BLU-YEL wires)

CLN6117A Cabinet Accessories Kit EPD-17913-O

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
	28A48250	ADAPTER, right angle


ANTENNA INPUT
J1 72-76 MC
RF AMPL. Q1 M9243
1ST. MIXER Q5 M9410
8MC IF AMPL. Q6 M9023
2ND. MIXER Q7 M9204
Z1 TFN6017CS 455 KC FILTER
Q9 M9357
TO 455KC IF AMPL.-1 Q10
A+ FROM 455KC IF BOARD
FROM CLN6206A AUTOMATIC FREQ. SELECT KIT (NOTE 6)
MULTIPLIER Q301 M9078
80.0-84.0 MC
CHANNEL ELEMENTS (NOTES 3 & 5)
F1 WARP
F2 WARP
2ND. OSC. Q8 M9003
Y303 8.455MC
A+ FROM R56
A+ FROM J2-8
METER 6 TO J2-6
455KC IF AMPL.-1 Q10 M9003
455KC IF AMPL.-2 Q11 M9199
455KC IF AMPL.-3 Q12 M9003
455KC IF 1ST. LIMITER Q13 M9199
455KC IF 2ND. LIMITER Q14 M9204
DISCRIMINATOR
METER 1 J2-1
METER 2 J2-2
METER 5 J2-5
METER 4 J2-4
A+ TO 455 KC FILTER
FROM J2-8 RECEIVER A+
P1 POWER CONNECTOR
A+ TO RF DECK
A+ TO J2-8
TO AUTOMATIC FREQ SELECT BOARD (SEE NOTE 6)
+14.0 VDC
DISC OUTPUT
GND
P1 DETAIL (WIRING SIDE)
63E81056A11-01
J2 METER RECEPTACLE
A+ TO OSC-MULTIPLIER BOARD
A+ TO 8-MC IF BOARD
A+ FROM P1-6
A+ TO 455 KC AMPL. BOARD
455 KC AMPL.-2
1ST OSCILLATOR
DISCR SECONDARY
DISCR PRIMARY
455KC AMPL.-3
J2 DETAIL (WIRING SIDE)
TRANSISTOR BASE DETAIL
CASE (TO GND)

MODEL TABLE

MODEL	SUFFIX	DESCRIPTION
CRC1000BB		RECEIVER, 1-FREQ
CRC1000BC		RECEIVER 2-FREQ

NOTES

1. [illegible]
2. [illegible]
3. [illegible]
4. [illegible]
5. [illegible]
6. USED IN 2-FR[illegible]
7. JUMPER[illegible]

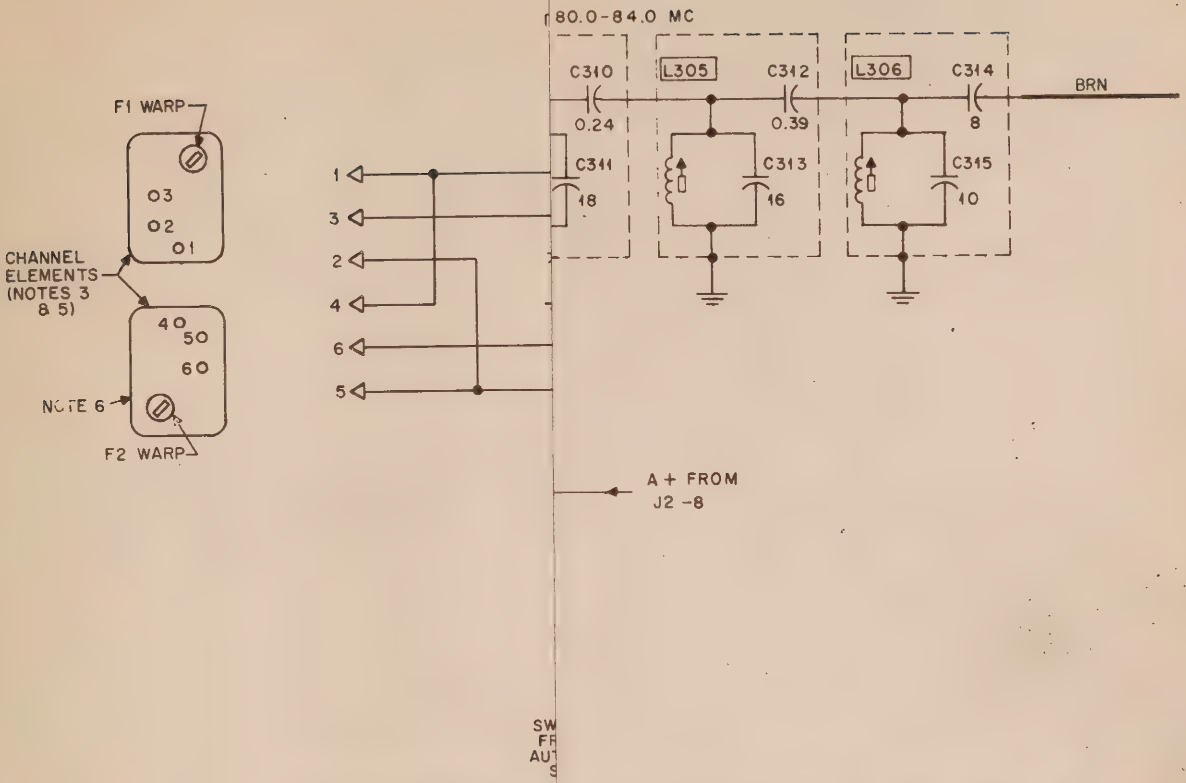
MODEL	SUFFIX	DESCRIPTION
CLN6207A		RECEIVER CHASSIS
TLC6000A		RF DECK
TLN6733BS		455 KC IF BOARD
CLN6205A		MULTIPLIER
CLN6206A*		AUTOMATIC FREQ. SELECT KIT
TLN8213A		8 MC IF & 2ND OSCILLATOR
TLN8013A		CABLE & SOCKET KIT
TFN6017CS		455 KC FILTER
TLN1081A		CHANNEL ELEMENT
G09		IF CRYSTAL

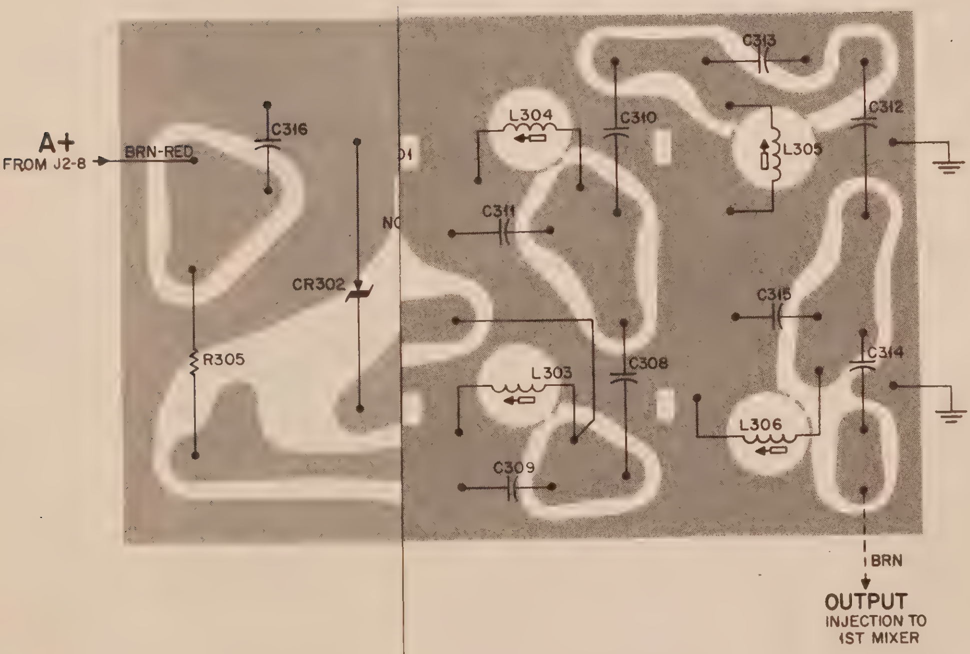
*USED IN CRC1000BC ONLY

EPD-21283-A

PREVIOUS REVISIONS AND PARTS LIST
SHOWN ON BACK OF THIS DIAGRAM

72-76 MC Receiver
Schematic Diagram
Motorola No. 63E81056A11-O1
8/28/68-RS


80.0-84.0 MC
C310
0.24
L305
C312
0.39
L306
C314
8
BRN
C311
18
C313
16
C315
10
F1 WARP
03
02
01
CHANNEL ELEMENTS (NOTES 3 & 5)
40
50
60
NOTE 6
F2 WARP
1
3
2
4
6
5
A + FROM J2 -8
SW
FR
AUT
S


A+
FROM J2-8
BRN-RED
C316
CR302
R305
01
NC
L304
C310
C311
L303
C308
C309
C313
L305
C312
C315
C314
L306
BRN
OUTPUT
INJECTION TO
1ST MIXER

PREVIOUS REVISIONS AND PARTS LIST
SHOWN ON BACK OF THIS DIAGRAM

CLN6205A Multiplier
Circuit Board Detail
Motorola No. PEPD-21262-A
8/28/68-RS

REVISIONS

DIAG. ISSUE	BOARD AND SUFFIX NO.	REF. SYMBOL	CHANGE	LOCATION
01			ADDED MODEL TABLES	NOTES

PARTS LIST

TLC6000A Receiver RF Deck (72-76 MC) EPD-21498-O

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
		CAPACITOR, fixed: uuf ±5%; 500 v
C101	21K847874	12; NP0
C102	21K865445	110 ±3%
C103, 105	21K859677	0.62
C104, 118	21K859899	15; 250 v
C106	21K848525	16; NP0
C107	21D82877B33	90 ±10%; N150; 50 v
C108, 111, 112	21C83191A01	.001 uf +100-0%
C109, 110	21K861219	.001 uf GMV; 500 v; coded RED
C113	21D82355B30	2.7 ±0.1 uuf
C114	21K857337	7.5 ±0.5 uuf; NP0
C115	21K842041	0.36
C116	21R410063	10 ±0.5 uuf; NP0
C117	21D82450B07	0.39
		SEMICONDUCTOR DEVICE, diode: (SEE NOTE)
CR101	48C864459	germanium
CR102	48C857965	silicon
		LAMP, glow:
DS1	65K817617	neon; 105-125 v; 1/25 w
		COIL, RF:
L1, 4, 5	24B83913A01	8-3/4 turn; does not incl. 1A864653 CORE, assy.: tuning
L2, 3	24B83914A01	10 turn; does not incl. 76K847160 CORE, tuning
L6	24B83914A02	1-1/4 turn; does not incl. 76K847160 CORE, tuning
		TRANSISTOR: (SEE NOTE)
Q1	48R869243	P-N-P; type M9243
		RESISTOR, fixed: ±5%; 1/4 w unl stated
R101	6K6229	1K ±10%; 1/2 w
R102	6S129804	2.2K
R103, 108	6S129669	4.7K
R104, 107	6S129753	100 ±10%
R105	6S129819	3.9K
R106	6K6397	22K ±10%; 1/2 w
		THERMISTOR:
RT101	6C82769A01	10 ohms

IF Filter EPD-21496-O

		FILTER, IF: 455 kc:
Z1	TFN6017CS	bandpass; 30 kc incl 1V80763A41 Amplifier Circuit Board Assembly (see detail EPD-21493)

TLN8013A Metering Socket & Cable Kit EPD-21497-O

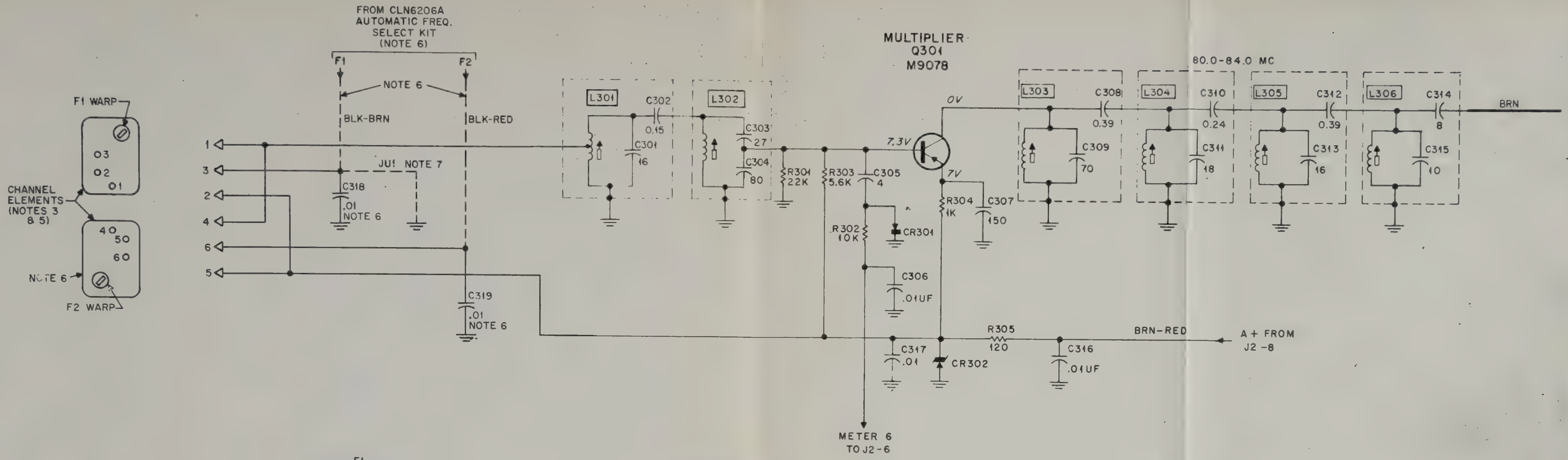
		CAPACITOR, fixed:
C77	21K800801	.0015 uf GMV +100%; max.; 500 v
		CONNECTOR, receptacle:
J2	9C857358	female; 12 contact

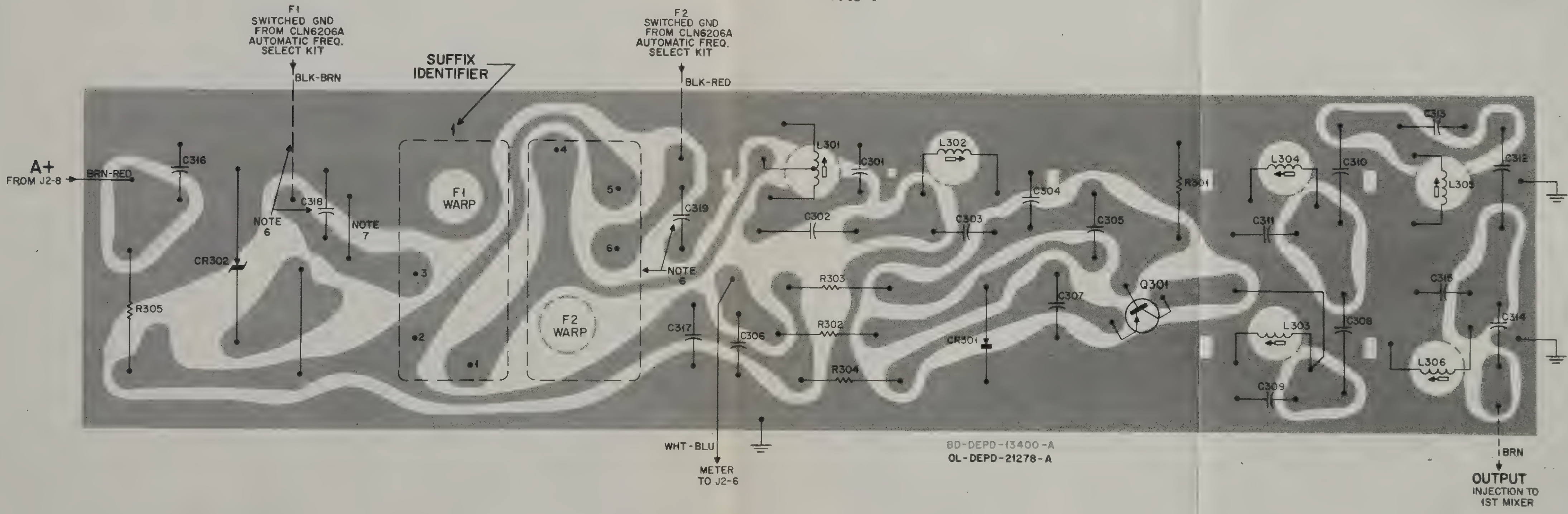
CLN6207A Receiver Chassis Kit EPD-21447-O

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
		CAPACITOR, fixed:
C73	23D82783B04	100 uf +150-10%; 25 v
		COIL, RF
L14	25B82719A02	choke; 10 mh
		CONNECTOR, plug:
P1	28K864121	female; 8 cont.
		RESISTOR, fixed:
R56	6S6326	100 ±10%; 1/2 w

NOTE:

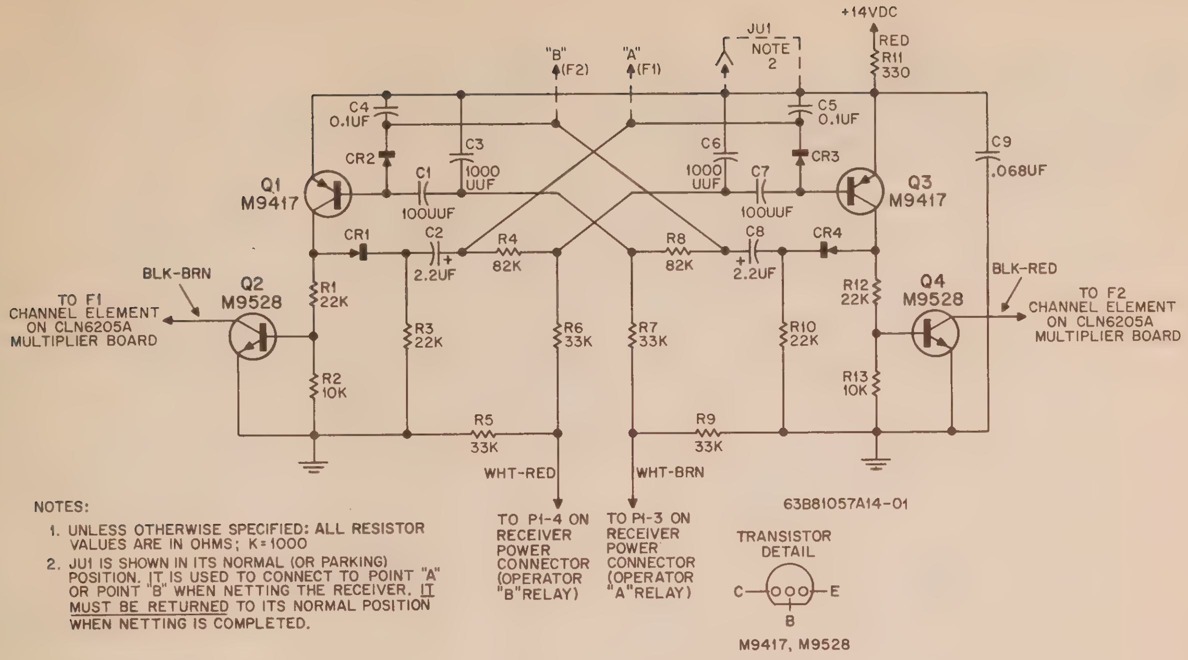
Replacement diodes and transistors must be ordered by Motorola part number only for optimum performance.


FROM CLN6206A AUTOMATIC FREQ. SELECT KIT (NOTE 6)
F1
F2
NOTE 6
BLK-BRN
BLK-RED
F1 WARP
03
02
01
CHANNEL ELEMENTS (NOTES 3 & 5)
40
50
60
NOTE 6
F2 WARP
1
3
2
4
6
5
JU1 NOTE 7
C318 .01 NOTE 6
C319 .01 NOTE 6
L301
C302 0.15
C301 16
L302
C303 27
C304 80
R301 22K
R303 5.6K
C305 4
R302 10K
CR301
C306 .01UF
MULTIPLIER Q301 M9078
0V
7.3V
7V
R304 1K
C307 150
80.0-84.0 MC
L303
C308 0.39
C309 70
L304
C310 0.24
C311 18
L305
C312 0.39
C313 16
L306
C314 8
C315 10
BRN
R305 120
BRN-RED
A+ FROM J2-8
C317 .01
CR302
C316 .01UF
METER 6 TO J2-6


F1 SWITCHED GND FROM CLN6206A AUTOMATIC FREQ. SELECT KIT
BLK-BRN
SUFFIX IDENTIFIER
F2 SWITCHED GND FROM CLN6206A AUTOMATIC FREQ. SELECT KIT
BLK-RED
A+ FROM J2-8
BRN-RED
C316
NOTE 6
C318
NOTE 7
CR302
R305
F1 WARP
F2 WARP
4
5
6
3
2
1
C319
NOTE 6
C317
C306
L301
C301
C302
L302
C303
C304
C305
R301
R303
R302
R304
CR301
C307
Q301
L304
C311
L303
C309
C310
C308
C313
L305
C312
C315
C314
L306
WHT-BLU
METER TO J2-6
BD-DEPD-13400-A
OL-DEPD-21278-A
BRN
OUTPUT INJECTION TO 1ST MIXER

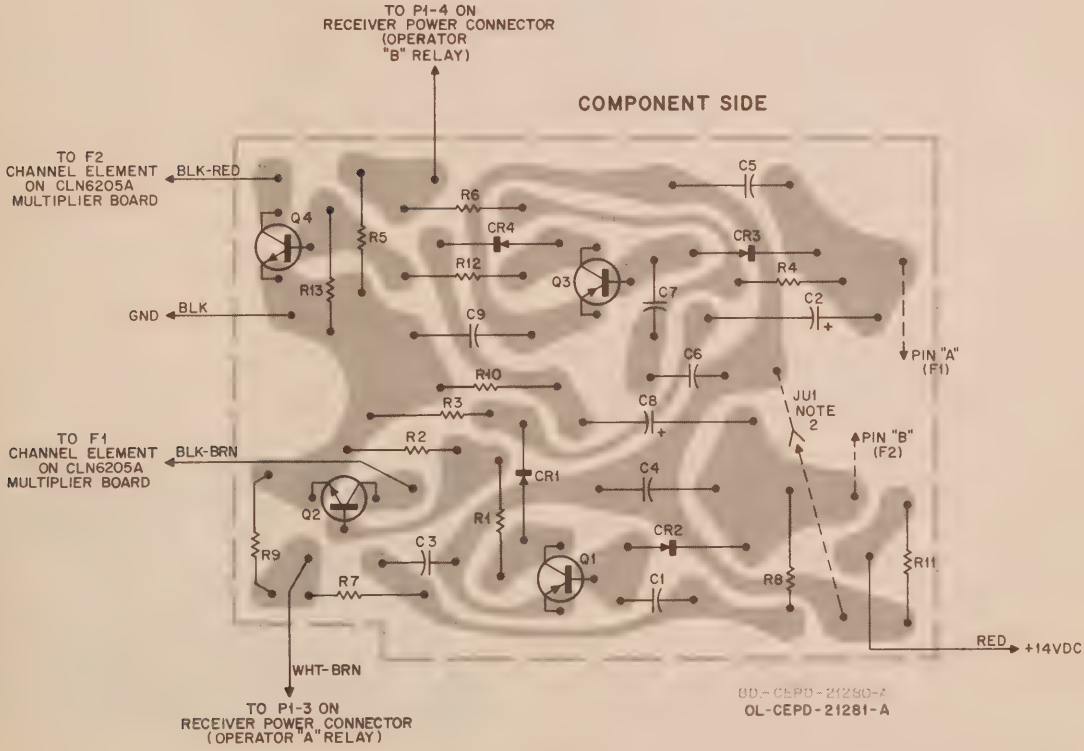
PREVIOUS REVISIONS AND PARTS LIST
SHOWN ON BACK OF THIS DIAGRAM

CLN6205A Multiplier
Circuit Board Detail
Motorola No. PEPD-21262-A
8/28/68-RS


+14VDC
RED
R11
330
JU1
NOTE
2
"B"
(F2)
"A"
(F1)
C4
0.1UF
C5
0.1UF
CR2
C3
1000
UUF
C6
1000
UUF
CR3
C9
.068UF
Q1
M9417
C1
100UUF
C7
100UUF
Q3
M9417
CR1
C2
2.2UF
R4
82K
R8
82K
C8
2.2UF
CR4
BLK-BRN
Q2
M9528
R1
22K
R12
22K
Q4
M9528
BLK-RED
TO F1
CHANNEL ELEMENT
ON CLN6205A
MULTIPLIER BOARD
R3
22K
R6
33K
R7
33K
R10
22K
TO F2
CHANNEL ELEMENT
ON CLN6205A
MULTIPLIER BOARD
R2
10K
R13
10K
R5
33K
R9
33K
WHT-RED
WHT-BRN
TO P1-4 ON
RECEIVER
POWER
CONNECTOR
(OPERATOR
"B" RELAY)
TO P1-3 ON
RECEIVER
POWER
CONNECTOR
(OPERATOR
"A" RELAY)
63B81057A14-01
TRANSISTOR
DETAIL
C
E
B
M9417, M9528

NOTES:

1. UNLESS OTHERWISE SPECIFIED: ALL RESISTOR VALUES ARE IN OHMS; K = 1000
2. JU1 IS SHOWN IN ITS NORMAL (OR PARKING) POSITION. IT IS USED TO CONNECT TO POINT "A" OR POINT "B" WHEN NETTING THE RECEIVER. IT MUST BE RETURNED TO ITS NORMAL POSITION WHEN NETTING IS COMPLETED.


TO P1-4 ON
RECEIVER POWER CONNECTOR
(OPERATOR
"B" RELAY)
COMPONENT SIDE
TO F2
CHANNEL ELEMENT
ON CLN6205A
MULTIPLIER BOARD
BLK-RED
C5
R6
Q4
R5
CR4
CR3
R12
Q3
R4
R13
GND
BLK
C7
C9
C2
PIN "A"
(F1)
C6
R10
R3
C8
JU1
NOTE
2
TO F1
CHANNEL ELEMENT
ON CLN6205A
MULTIPLIER BOARD
BLK-BRN
R2
PIN "B"
(F2)
CR1
C4
Q2
R1
CR2
R9
C3
Q1
R11
R7
C1
R8
RED
+14VDC
WHT-BRN
TO P1-3 ON
RECEIVER POWER CONNECTOR
(OPERATOR "A" RELAY)
BD-CEPD-21280-A
OL-CEPD-21281-A

PREVIOUS REVISIONS AND PARTS LIST
SHOWN ON BACK OF THIS DIAGRAM

CLN6206A Automatic Frequency Select Kit
Schematic Diagram and Circuit Board Detail
Motorola No. PEPD-21279-A
8/28/68-RS

REVISIONS

DIAG. ISSUE	BOARD AND SUFFIX NO.	REF. SYMBOL	CHANGE	LOCATION
A	CLN6205A	L303	REMOVED CENTER-TAP	OVERLAY

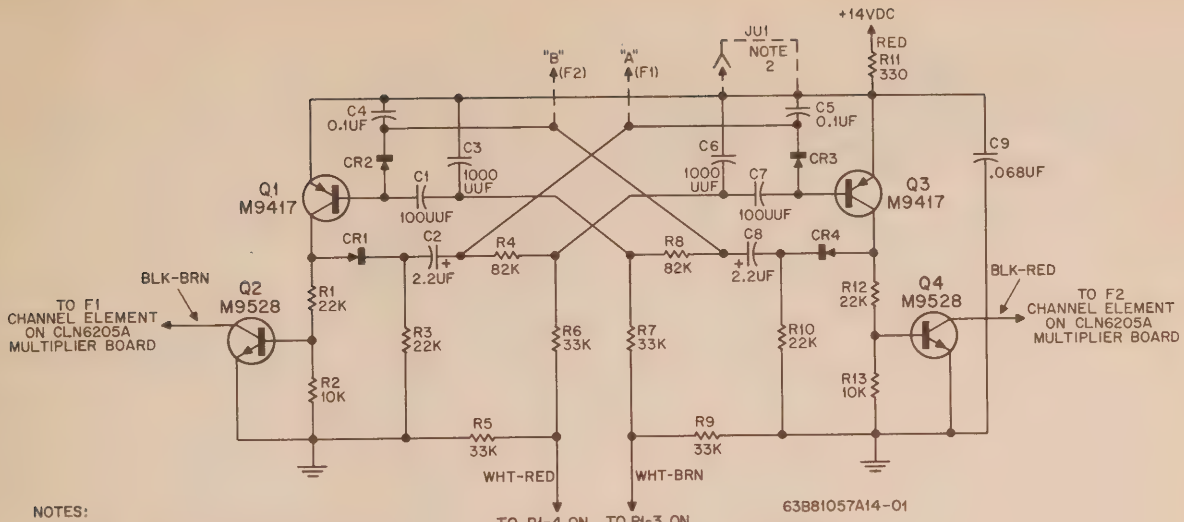
PARTS LIST

CLN6205A Multiplier Kit EPD-21448-O

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
		CAPACITOR, fixed: uuf ±5% 500 v
C301	21D82133G49	16; NP0
C302	21K881064	0.15
C303	21D82133G38	27; N150
C304	21K847091	80 ±2%; 300 v
C305	21K867844	4 ±0.5 uuf
C306, 316, 317	21D82428B32	.01 uf +70-30%; 100 v
C307	21K840047	150
C308, 312	21C82450B07	0.39
C309	21K861435	70 ±10%; N150; 75 v
C310	21K867162	0.24
C311	21D82355B02	18; N220
C313	21K864734	16; N220
C314	21K847743	8 ±0.5 uuf; NP0
C315	21K859215	10; N220
		SEMICONDUCTOR DEVICE, diode: (SEE NOTE)
CR301	48D82139G01	germanium
CR302	48D82533D10	zener
		COIL, RF:
L301	24V80902A95	assy; incl. 24A82429H01, COIL, 13-3/4 turn; does not incl. 76B82572G03 CORE, tuning
L302	24A82430H01	13-1/4 turn; does not incl. 76B82572G03 CORE, tuning
L303	24V80904A57	assy; incl. 24A82102H01 COIL, 2-1/2 turn; does not incl. 76B82572G03 CORE, tuning
L304, 305, 306	24A82430H02	5-1/4 turn; does not incl. 76B82572G03 CORE, tuning
		TRANSISTOR: (SEE NOTE)
Q301	48R869078	P-N-P; type M9078
		RESISTOR, fixed: ±10%; 1/4 w; unl stated
R301	6S128685	22K
R302	6S129225	10K
R303	6S129433	5.6K
R304	6S127802	1K
R305	6S121691	120 ±5%; 1/2 w

NOTE:

Replacement diodes and transistors must be ordered by Motorola part number only for optimum performance.


+14VDC
RED
R11
330
JU1
NOTE
2
"B"
(F2)
"A"
(F1)
C4
0.1UF
C3
1000
UUF
CR2
C1
100UUF
Q1
M9417
CR1
C2
2.2UF
R4
82K
R8
82K
C8
2.2UF
CR4
C5
0.1UF
C6
1000
UUF
CR3
C7
100UUF
Q3
M9417
C9
.068UF
BLK-BRN
TO F1
CHANNEL ELEMENT
ON CLN6205A
MULTIPLIER BOARD
Q2
M9528
R1
22K
R2
10K
R3
22K
R6
33K
R7
33K
R10
22K
R12
22K
R13
10K
Q4
M9528
BLK-RED
TO F2
CHANNEL ELEMENT
ON CLN6205A
MULTIPLIER BOARD
R5
33K
R9
33K
WHT-RED
WHT-BRN
63B81057A14-01

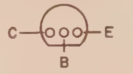
TO P1-4 ON RECEIVER POWER CONNECTOR (OPERATOR "B" RELAY)

TO P1-3 ON RECEIVER POWER CONNECTOR (OPERATOR "A" RELAY)

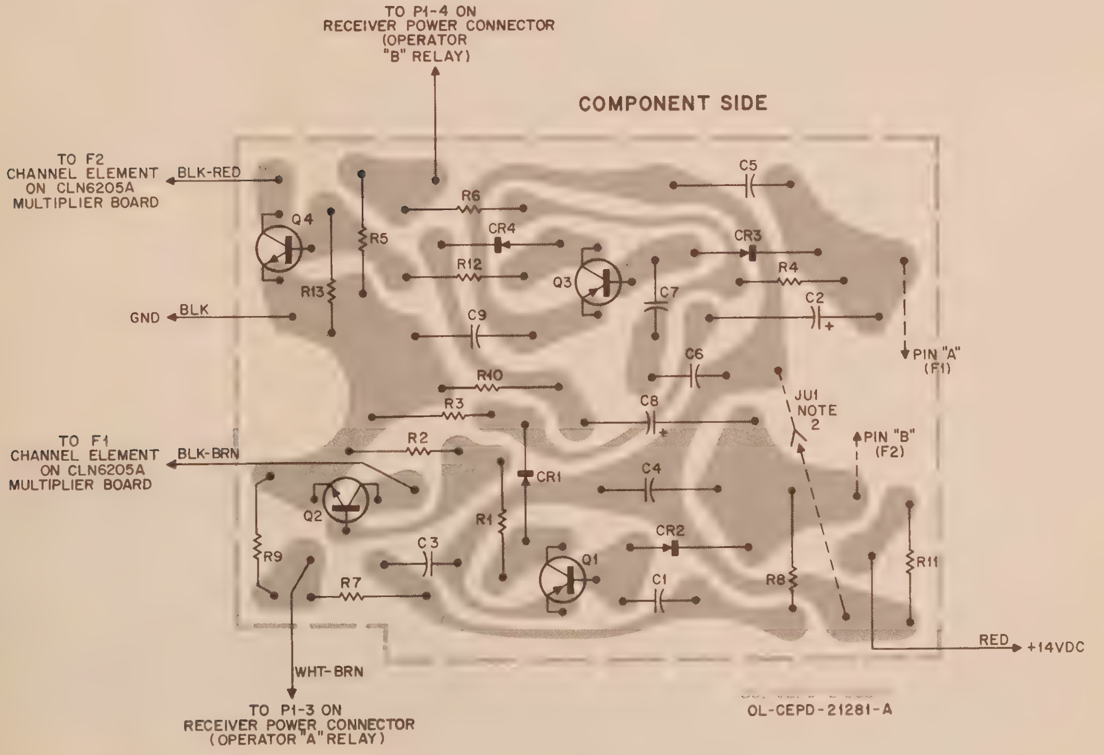
NOTES:

1. UNLESS OTHERWISE SPECIFIED: ALL RESISTOR VALUES ARE IN OHMS; K=1000
2. JU1 IS SHOWN IN ITS NORMAL (OR PARKING) POSITION. IT IS USED TO CONNECT TO POINT "A" OR POINT "B" WHEN NETTING THE RECEIVER. IT MUST BE RETURNED TO ITS NORMAL POSITION WHEN NETTING IS COMPLETED.

TRANSISTOR DETAIL



M9417, M9528


TO P1-4 ON
RECEIVER POWER CONNECTOR
(OPERATOR
"B" RELAY)
COMPONENT SIDE
TO F2
CHANNEL ELEMENT
ON CLN6205A
MULTIPLIER BOARD
BLK-RED
C5
R6
CR4
CR3
Q4
R5
R12
R4
Q3
R13
C7
C2
GND
BLK
C9
PIN "A"
(F1)
C6
R10
R3
C8
JU1
NOTE
2
PIN "B"
(F2)
TO F1
CHANNEL ELEMENT
ON CLN6205A
MULTIPLIER BOARD
BLK-BRN
R2
CR1
C4
Q2
R1
C3
CR2
R9
Q1
R11
R7
C1
R8
RED
+14VDC
WHT-BRN
TO P1-3 ON
RECEIVER POWER CONNECTOR
(OPERATOR "A" RELAY)

OL-CEPD-21281-A

PREVIOUS REVISIONS AND PARTS LIST SHOWN ON BACK OF THIS DIAGRAM

CLN6206A Automatic Frequency Select Kit
Schematic Diagram and Circuit Board Detail
Motorola No. PEPD-21279-A
8/28/68-RS

REVISIONS

DIAG. ISSUE	BOARD AND SUFFIX NO.	REF. SYMBOL	CHANGE	LOCATION
A	CLN6206A		MODIFIED BOARD AND OVERLAY	PRINTED CKT. BD.

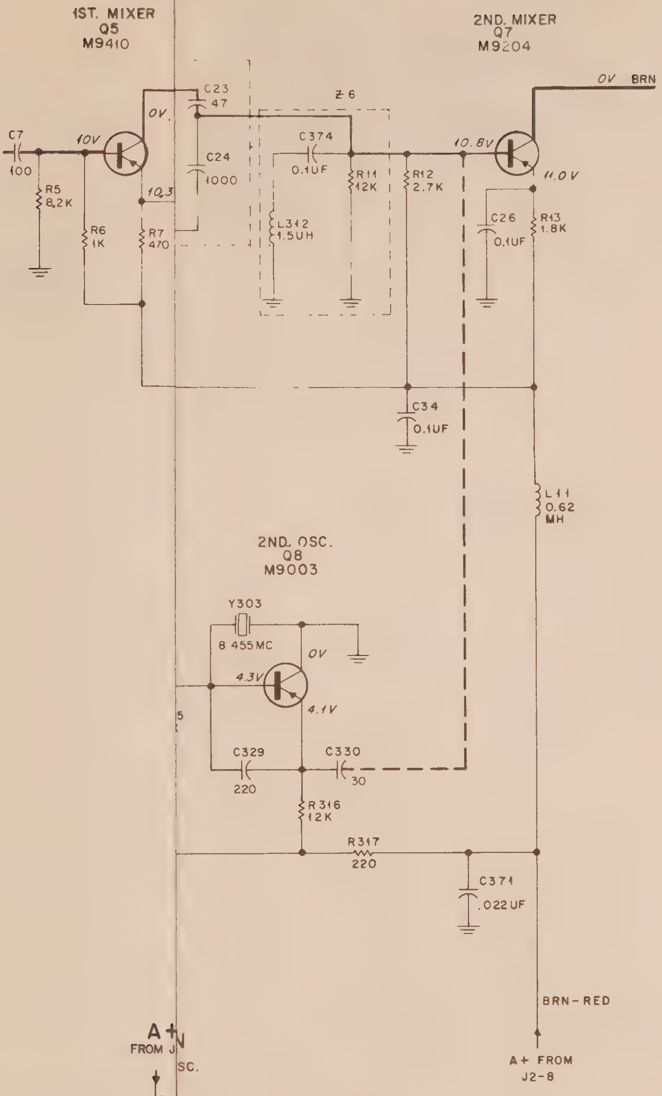
PARTS LIST

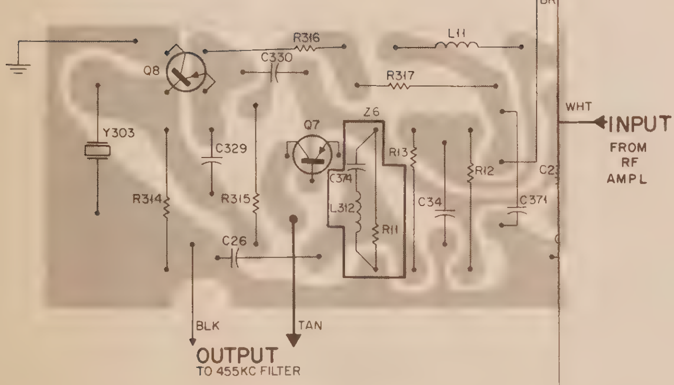
CLN6206A Automatic Frequency Selector Kit EPD-21452-O

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
		CAPACITOR, fixed:
C1, 7	21K840046	100 uuf ±10%; 500 v
C2, 8	23D82783B16	2.2 uf ±10%; 15 v
C3, 6	21C82187B20	1000 uuf ±10%; 100 v
C4, 5	8D82905G07	0.1 uf ±10%; 50 v
C9	8D82905G04	.068 uf ±10%; 50 v
		SEMICONDUCTOR DEVICE, diode: (SEE NOTE)
CR1, 2, 3, 4	48C82392B03	silicon; RD1343
		TRANSISTOR; (SEE NOTE)
Q1, 3	48R869417	P-N-P; type M9417
Q2, 4	48R869528	N-P-N; type M9528
		RESISTOR, fixed: ±5%; 1/4 w; unl stated
R1, 3, 10, 12	6S129667	22K
R2, 13	6S129668	10K
R4, 8	6S124A95	82K
R5, 6, 7, 9	6S129526	33K
R11	6S129806	330

NOTE:

Replacement diodes and transistors must be ordered by Motorola part number only for optimum performance.


1ST. MIXER
Q5
M9410
2ND. MIXER
Q7
M9204
0V BRN
C7
100
10V
0V.
C23
47
C24
1000
10.3
R5
8.2K
R6
1K
R7
470
Z6
C374
0.1UF
R11
12K
R12
2.7K
L312
1.5UH
10.8V
11.0V
C26
0.1UF
R13
1.8K
C34
0.1UF
L11
0.62
MH
2ND. OSC.
Q8
M9003
Y303
8 455MC
0V
4.3V
4.1V
C329
220
C330
30
R316
12K
R317
220
C371
.022UF
BRN-RED
A+ FROM
J2-8
A+
FROM J
SC.
BR


R316
C330
L11
Q8
R317
WHT
INPUT
FROM
RF
AMPL
Y303
C329
Q7
Z6
R13
R12
C2
C374
L312
C34
C371
R314
R315
R11
C26
BLK
TAN
OUTPUT
TO 455KC FILTER

PREVIOUS REVISIONS AND PARTS LIST
SHOWN ON BACK OF THIS DIAGRAM

TLN8213A, 8 MC IF & 2nd Oscillator
Circuit Board Detail
Motorola No. EPD-11188-C
8/28/68-RS

REVISIONS

DIAG. ISSUE	BOARD AND SUFFIX NO.	REF. SYMBOL	CHANGE	LOCATION
A	CLN6206A		MODIFIED BOARD AND OVERLAY	PRINTED CKT. BD.

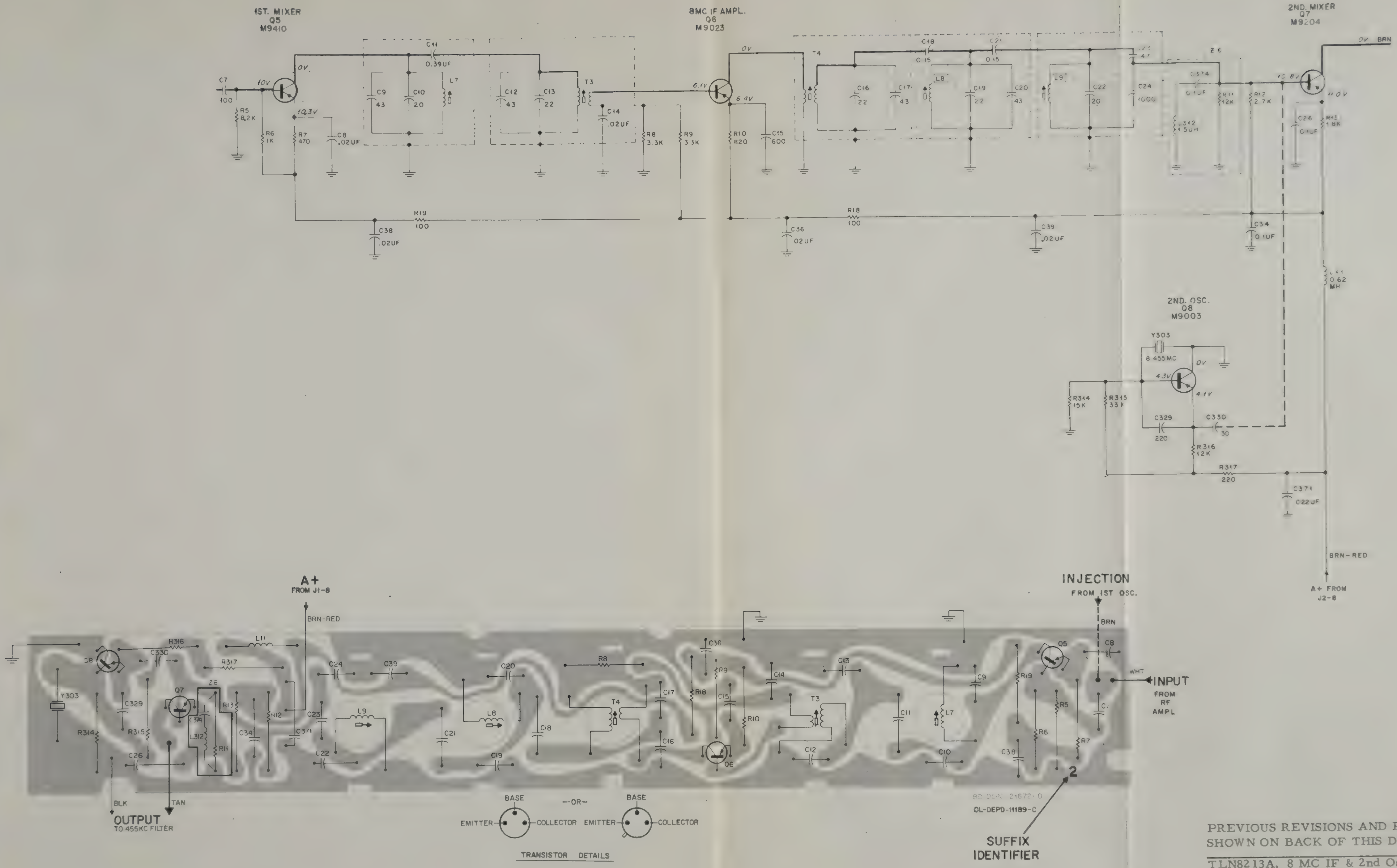
PARTS LIST

CLN6206A Automatic Frequency Selector Kit EPD-21452-O

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
		CAPACITOR, fixed:
C1, 7	21K840046	100 uuf ±10%; 500 v
C2, 8	23D82783B16	2.2 uf ±10%; 15 v
C3, 6	21C82187B20	1000 uuf ±10%; 100 v
C4, 5	8D82905G07	0.1 uf ±10%; 50 v
C9	8D82905G04	.068 uf ±10%; 50 v
		SEMICONDUCTOR DEVICE, diode: (SEE NOTE)
CR1, 2, 3, 4	48C82392B03	silicon; RD1343
		TRANSISTOR; (SEE NOTE)
Q1, 3	48R869417	P-N-P; type M9417
Q2, 4	48R869528	N-P-N; type M9528
		RESISTOR, fixed: ±5%; 1/4 w; unl stated
R1, 3, 10, 12	6S129667	22K
R2, 13	6S129668	10K
R4, 8	6S124A95	82K
R5, 6, 7, 9	6S129526	33K
R11	6S129806	330

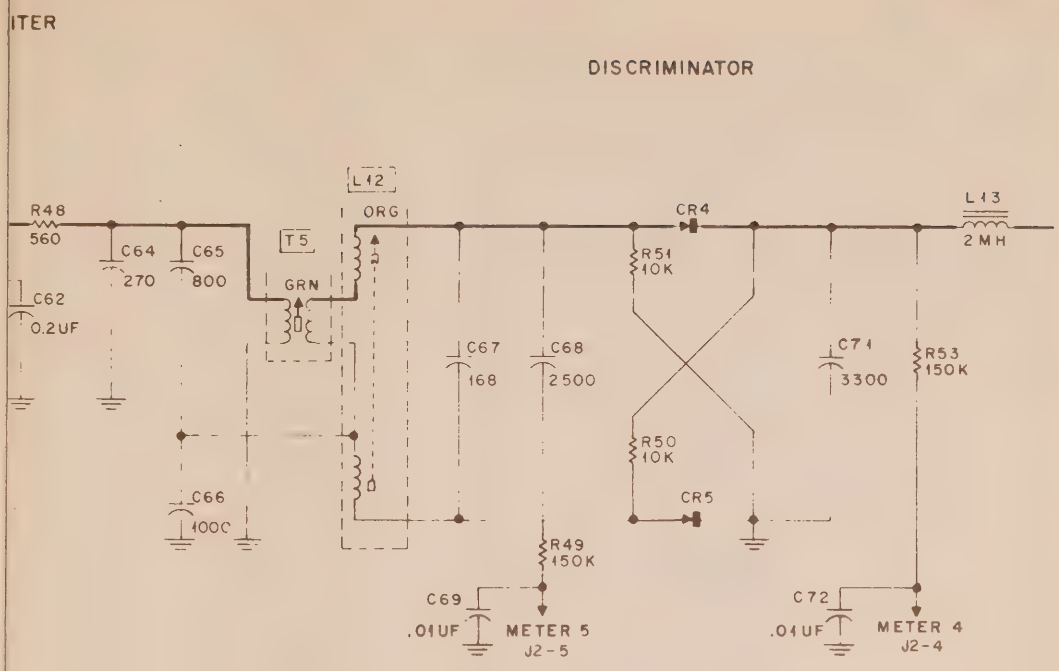
NOTE:

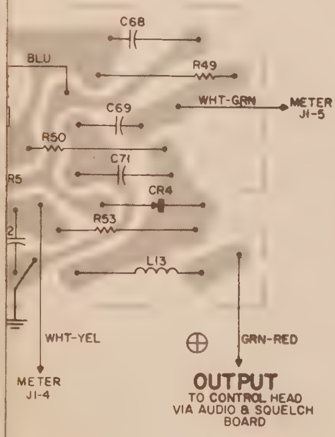
Replacement diodes and transistors must be ordered by Motorola part number only for optimum performance.


1ST. MIXER
Q5
M9410
8MC IF AMPL.
Q6
M9023
2ND. MIXER
Q7
M9204
2ND. OSC.
Q8
M9003
C7
100
R5
8.2K
R6
1K
R7
470
C8
.02UF
C11
0.39UF
C9
43
C10
20
L7
C12
43
C13
22
T3
C14
.02UF
R8
3.3K
R9
3.3K
R10
820
C15
600
T4
C16
22
C17
43
C18
0.15
L8
C19
22
C20
43
C21
0.15
L9
C22
20
C24
1000
Z6
C374
0.1UF
R11
12K
R12
2.7K
R13
1.8K
C26
0.1UF
L312
1.5UH
R19
100
C38
.02UF
R18
100
C36
.02UF
C39
.02UF
C34
0.1UF
L11
0.62
MH
Y303
8.455MC
R314
15K
R315
33K
C329
220
C330
30
R316
12K
R317
220
C371
0.22UF
0V
10V
12.3V
6.1V
6.4V
15.8V
11.0V
4.3V
4.1V
BRN
BRN-RED
A+ FROM
J2-8
A+
FROM J1-8
INJECTION
FROM 1ST OSC.
WHT
INPUT
FROM
RF
AMPL
BLK
TAN
OUTPUT
TO 455KC FILTER
BASE
EMITTER
COLLECTOR
—OR—
TRANSISTOR DETAILS
BD-DEPD-21872-0
OL-DEPD-11189-C
2
SUFFIX
IDENTIFIER

PREVIOUS REVISIONS AND PARTS LIST
SHOWN ON BACK OF THIS DIAGRAM

TLN8213A, 8 MC IF & 2nd Oscillator
Circuit Board Detail
Motorola No. EPD-11188-C
8/28/68-RS


ITER
DISCRIMINATOR
R48
560
C62
0.2UF
C64
270
C65
800
T5
GRN
L12
ORG
C66
1000
C67
168
C68
2500
R49
150K
C69
.01UF
METER 5
J2-5
CR4
R51
10K
R50
10K
CR5
C71
3300
R53
150K
L13
2MH
C72
.01UF
METER 4
J2-4


C68
BLU
R49
WHT-GRN
METER
J1-5
C69
R50
C71
R5
CR4
R53
L13
WHT-YEL
METER
J1-4
GRN-RED
OUTPUT
TO CONTROL HEAD
VIA AUDIO & SQUELCH
BOARD

PARTS LIST SHOWN ON
BACK OF THIS DIAGRAM

455 KC IF Circuit Board Detail
Model TLN6733BS (Split Channel) &
TLN6733BW (Wide Channel)
Motorola No. EPD-21584-O
8/28/68-RS

REVISIONS

DIAG. ISSUE	BOARD AND SUFFIX NO.	REF. SYMBOL	CHANGE	LOCATION
A	TLN8213A-1	Q7	WAS 48R869133, M9133	LEFT OF CKT. BD.
B	TLN8213A-2	Q5	WAS 48R869280, M9280	RIGHT OF CKT. BD.
		R7	WAS 6R6393, 1.2K	PARTS LIST
C	TLN8213A-2		BRN LEAD, WAS WHT	RIGHT OF CKT BD.

PARTS LIST

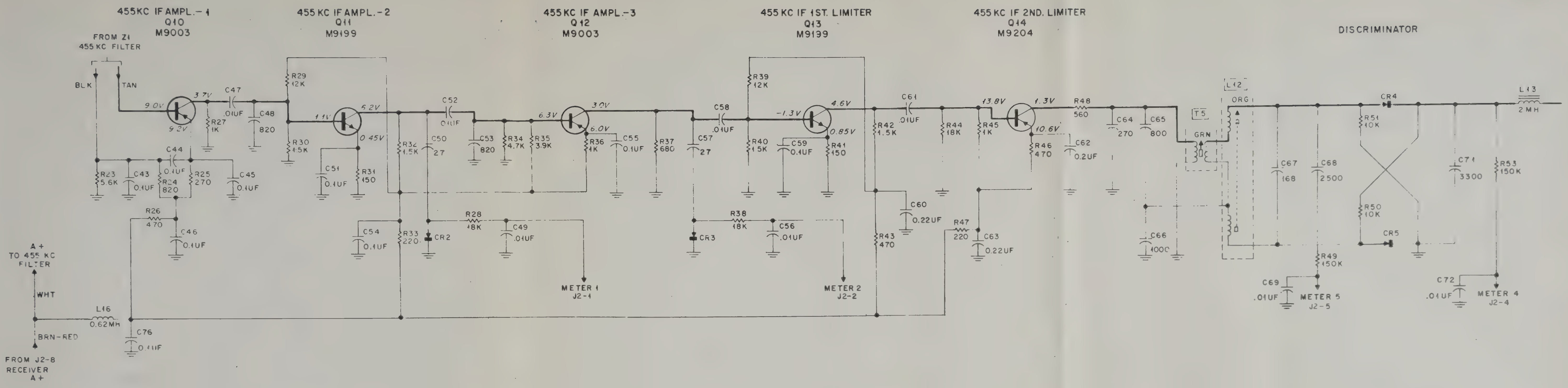
TLN8213A 8 MC. 1st IF & 2nd Osc. Kit EPD-12142-B

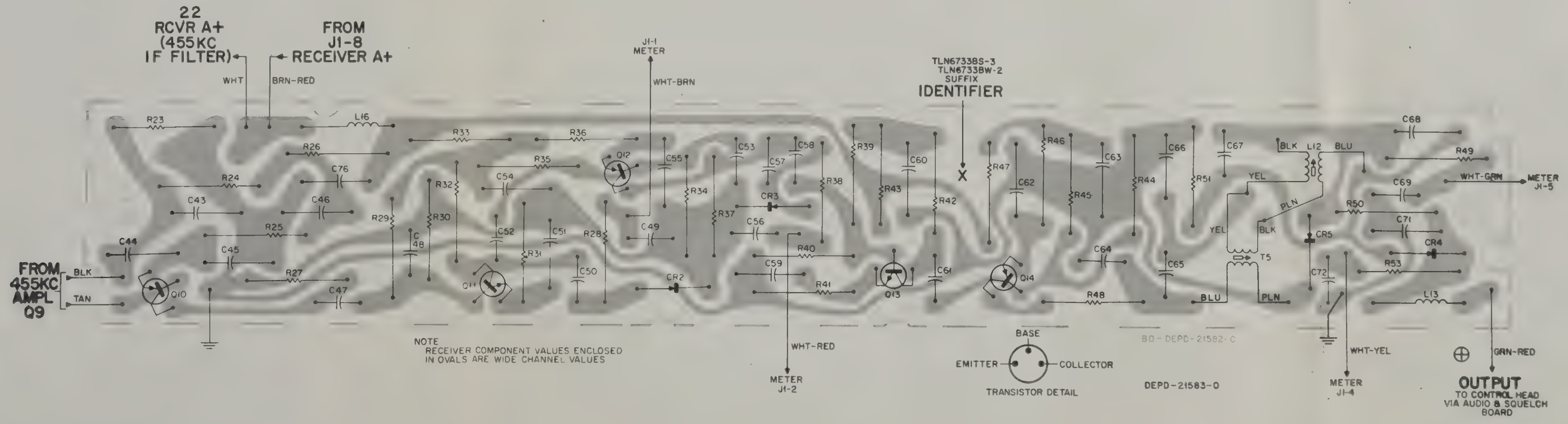
REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
		CAPACITOR, fixed: uuf; 5%; 500 v; unl. stated
C7	21K850118	100
C8, 14, 36, 38, 39, 331	21D82428B18	.02 uf -40+60%; 100 v
C9, 12, 17, 20	21D82537B07	43
C10, 22	21D82133G24	20; N330
C11	21C82450B07	0.39
C13, 16, 19	21D82133G20	22; N330
C15	21D82428B34	600 ±10%; 600 v
C18, 21	21K881064	0.15
C23	21K868681	47
C24	21D82537B16	1000 ±5%; 100 v
C26, 34	8C82095G06	0.1 uf ±10%; 200 v
C329	21K859942	220
C330	21D82133G17	30; N1500
C371	8D82905G02	.022 uf ±10%; 25 v
C374		0.1 uf +80-20%; 25 v (p/o Z6)
		COIL, IF:
L7, 8, 9	24V80902A30	incl. 1V80728A92 CORE, tuning
L11	24D82135G08	choke: 620 uh
L312		choke: 1.5 uh; (p/o Z6)
		TRANSISTOR, (SEE NOTE I)
Q5	48R869410	P-N-P; type M9410
Q6	48R869023	P-N-P; type M9023
Q7	48R869204	P-N-P; type M9204
Q8	48R869003	P-N-P; type M9003
		RESISTOR, fixed: ±10%; 1/2 w; unl stated
R5	6R2004	8.2K
R6	6R6229	1K
R7	6R6090	470
R8, 9	6R5581	3.3K
R10	6R6269	820
R11		12K (p/o Z6)
R12	6R5577	2.7K
R13	6R2089	1.8K
R18, 19	6R6326	100
R314	6R5726	15K ±5%
R315	6R6410	33K
R316	6R6394	12K
R317	6R6270	220
		TRANSFORMER, IF:
T3	24V80902A31	incl. 1V80728A92 CORE, tuning
T4	24V80902A32	incl. 1V80728A92 CORE, tuning
		CRYSTAL UNIT, quartz (SEE NOTE II)
Y303	G09	8.455 mc
		NETWORK; filter:
Z6	1V80741A58	incl. refer. parts C374, L312, R11
	NON-REFERENCED ITEM	
	26K858660	SHIELD, coil: 5 req'd

NOTES:

I. Replacement transistors and diodes must be ordered by Motorola part number only for optimum performance.

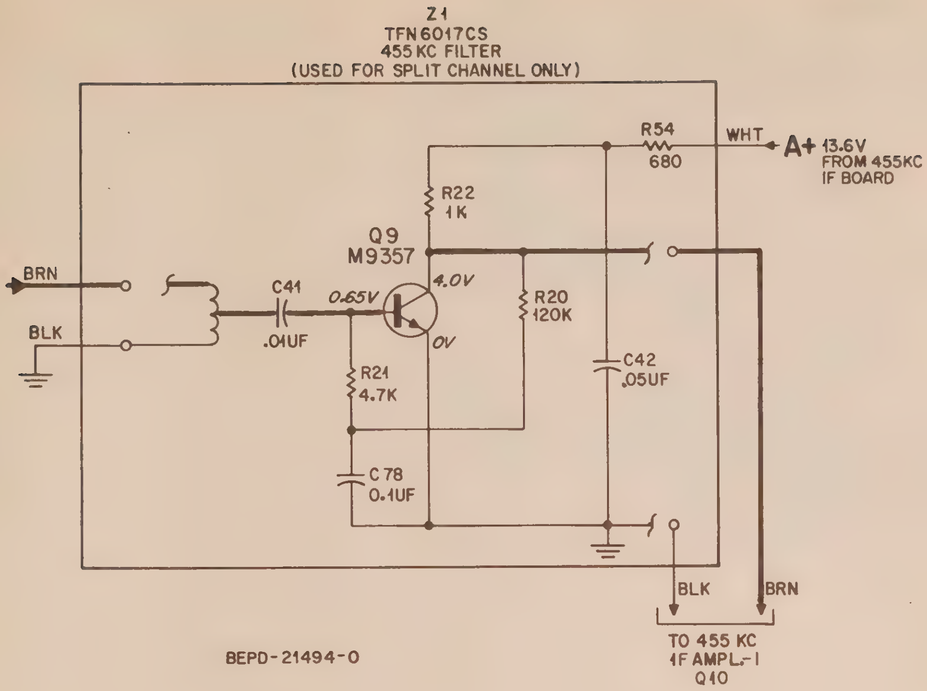
II. When ordering xtal units, specify car. freq.(s), xtal freq.(s) and xtal type no.

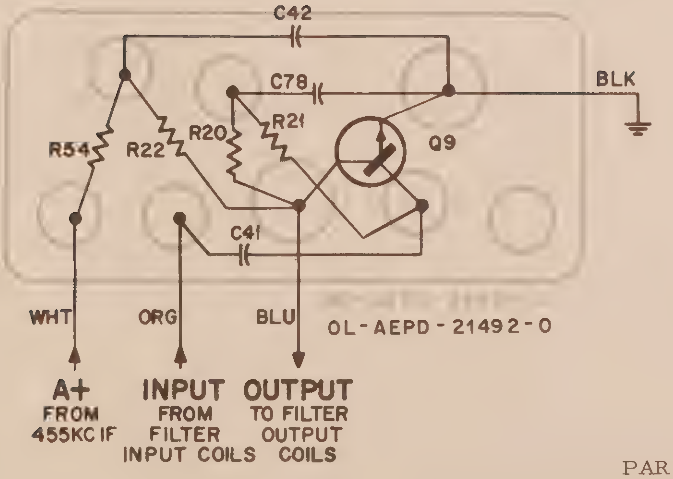

455KC IF AMPL.-1
Q10
M9003
455KC IF AMPL.-2
Q11
M9199
455KC IF AMPL.-3
Q12
M9003
455KC IF 1ST. LIMITER
Q13
M9199
455KC IF 2ND. LIMITER
Q14
M9204
DISCRIMINATOR
FROM Z1
455 KC FILTER
BLK
TAN
9.0V
9.2V
3.7V
C47
.01UF
R27
1K
C48
820
R29
12K
R30
1.5K
1.1V
5.2V
0.45V
C51
0.1UF
R31
150
R23
5.6K
C43
0.1UF
C44
0.1UF
R24
820
R25
270
C45
0.1UF
R26
470
C46
0.1UF
A+
TO 455 KC
FILTER
WHT
L16
0.62MH
BRN-RED
FROM J2-8
RECEIVER
A+
C76
0.1UF
R32
1.5K
C50
27
C52
0.1UF
C53
820
R34
4.7K
R35
3.9K
6.3V
3.0V
6.0V
R36
1K
C55
0.1UF
R37
680
C54
0.1UF
R33
220
CR2
R28
18K
C49
.01UF
METER 1
J2-1
C57
27
C58
.01UF
R39
12K
R40
1.5K
C59
0.1UF
-1.3V
4.6V
0.85V
R41
150
CR3
R38
18K
C56
.01UF
METER 2
J2-2
R42
1.5K
C61
.01UF
R44
18K
C60
0.22UF
R43
470
R47
220
C63
0.22UF
13.8V
1.3V
10.6V
R45
1K
R46
470
C62
0.2UF
R48
560
C64
270
C65
800
C66
1000
T5
GRN
L12
ORG
C67
168
C68
2500
R49
150K
C69
.01UF
METER 5
J2-5
CR4
R51
10K
R50
10K
CR5
C71
3300
R53
150K
C72
.01UF
METER 4
J2-4
L13
2MH


22
RCVR A+
(455KC
IF FILTER)
WHT
BRN-RED
FROM
J1-8
RECEIVER A+
J1-1
METER
WHT-BRN
TLN6733BS-3
TLN6733BW-2
SUFFIX
IDENTIFIER
X
FROM
455KC
AMPL
Q9
BLK
TAN
R23
L16
R26
R33
R36
R24
C76
R32
C54
R35
Q12
C55
C53
C58
R39
C60
R47
R46
C63
C66
C67
BLK
L12
BLU
C68
R49
WHT-GRN
METER
J1-5
C43
C46
R25
R29
R30
C48
C52
C51
R28
C49
R34
R37
CR3
C56
C57
R38
R43
R42
C62
R45
R44
R51
YEL
PLN
C69
R50
C71
CR5
CR4
C44
C45
R27
C47
Q10
Q11
R31
C50
CR2
C59
R40
R41
Q13
C61
Q14
C64
C65
T5
BLU
PLN
C72
R53
L13
R48
BD-DEPD-21582-C
NOTE
RECEIVER COMPONENT VALUES ENCLOSED
IN OVALS ARE WIDE CHANNEL VALUES
WHT-RED
METER
J1-2
BASE
EMITTER
COLLECTOR
TRANSISTOR DETAIL
DEPD-21583-O
WHT-YEL
METER
J1-4
GRN-RED
OUTPUT
TO CONTROL HEAD
VIA AUDIO & SQUELCH
BOARD

PARTS LIST SHOWN ON
BACK OF THIS DIAGRAM

455 KC IF Circuit Board Detail
Model TLN6733BS (Split Channel) &
TLN6733BW (Wide Channel)
Motorola No. EPD-21584-O
8/28/68-RS


Z1
TFN6017CS
455 KC FILTER
(USED FOR SPLIT CHANNEL ONLY)
R54
680
WHT
A+ 13.6V
FROM 455KC
IF BOARD
R22
1K
Q9
M9357
4.0V
0.65V
0V
BRN
BLK
C41
.01UF
R20
120K
R21
4.7K
C42
.05UF
C 78
0.1UF
BLK
BRN
TO 455 KC
IF AMPL.-I
Q10
BEPD-21494-0


C42
C78
BLK
R21
R20
R54
R22
Q9
C41
WHT
ORG
BLU
OL-AEPD-21492-0
A+
FROM
455KC IF
INPUT
FROM
FILTER
INPUT COILS
OUTPUT
TO FILTER
OUTPUT
COILS

PARTS LIST SHOWN ON
BACK OF THIS DIAGRAM

455 KC Filter Amplifier
Circuit Board Detail
Motorola No. EPD-21493-O
8/28/68-RS

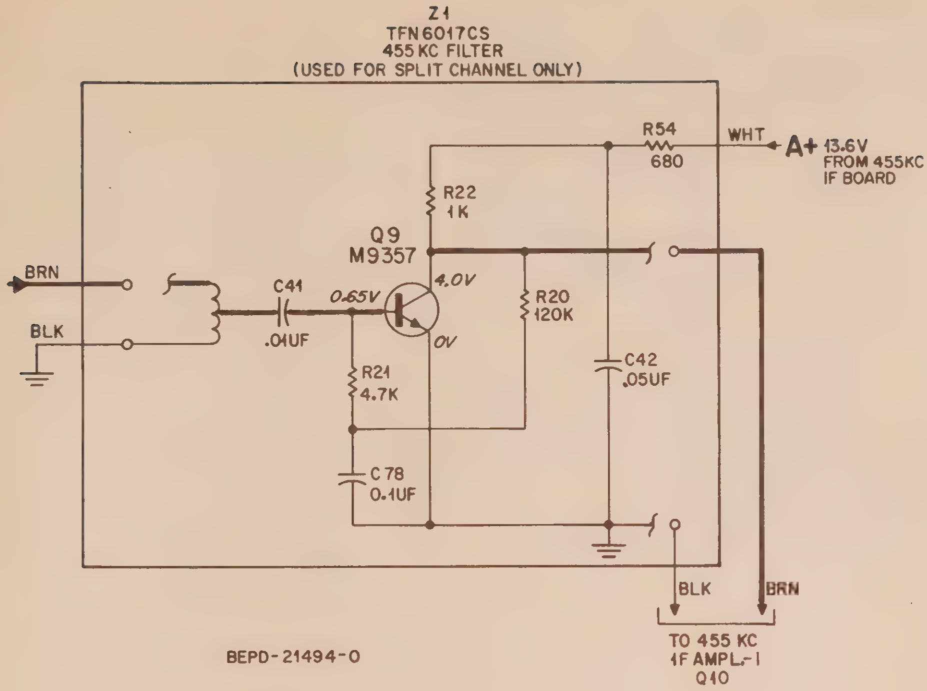
PARTS LIST

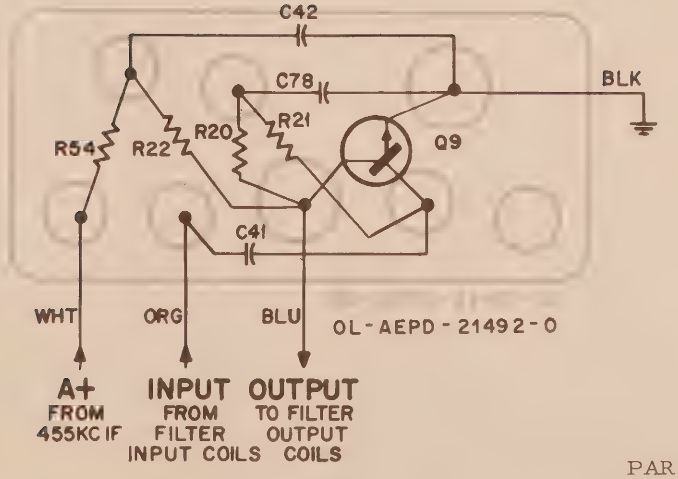
TLN6733BS 455 KC Board (30 KC)
TLN6733BW 455 KC Board (60 KC) EPD-21585-O

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
		CAPACITOR, fixed: uuf; 500 v; unl stated
C43, 44, 45, 51, 55, 59	21C82372C01	0.1 uf +80-20%; 25 v
C46, 54, 76	8C82095G06	0.1 uf mylar; 200 v; ±10%
C47, 49, 52, 56, 58, 61, 69, 72	21D82428B59	.01 uf +80-20%; 200 v
C48, 53	21C82187B23	820 ±10%
C50, 57	21D82133G23	27 ±10%; NP0
C60, 63	8D82905G11	.22 uf ±10%; 25 v
C62	21C82372C02	0.2 uf +80-20%; 25 v
C64	21K859178	270 ±5%; 300 v; 30 kc
C65	21K840049	800 ±5%; 300 v; 30 kc
	or 21K859945	390 ±5%; 60 kc
C66	21K847601	1000 ±5%; 30 kc
	or 21K864736	1300 ±5%; 60 kc
C67	21D82133G61	168 ±10%; N2200; 500 v
C68	21K859773	2500 ±5%
C71	21C82187B25	3300 ±10%
		SEMICONDUCTOR DEVICE, diode (SEE NOTE)
CR2, 3	48C82921G01	germanium
CR4, 5	48C82139G01	germanium
		COIL, discriminator:
L12	24C82619C05	455 kc; ORG incl 1K867236 CORE, tuning
L13	24D82135G07	choke; 2 mh; sleeved
L16	24D82135G08	choke; 0.62 mh; sleeved
		TRANSISTOR, (SEE NOTE)
Q10	48R869443	P-N-P; type M9443
Q11, 13	48R869199	N-P-N; type M9199
Q12	48R869003	P-N-P; type M9003
Q14	48R869204	P-N-P; type M9204
		RESISTOR, fixed: ±10%; 1/2 w; unl stated
R23	6R6117	5.6K
R24	6R6269	820
R25	6R6432	270
R26, 43, 46	6R6090	470
R27, 36, 45	6R6229	1K
R28, 38, 44	6R5591	18K
R29, 39	6R6394	12K
R30, 32, 40, 42	6R6038	1.5K
R31, 41	6R6373	150
R33, 47	6R6270	220
R34	6R6080	4.7K
R35	6R5659	3.9K
R37	6R6040	680
R48	6R6040	680 (60 KC)
	or 6R6291	560 (30 KC)
R49	6R6398	150K
R50, 51	6R5556	10K ±5%; 30 kc
	or 6R3924	4.7K ±5%; 60 kc
R53	6R6398	150K 30 kc
	or 6R6074	68K 60 kc
		TRANSFORMER, discriminator;
T5	24C82619C06	GRN; incl. 1K867236 CORE, tuning; 30 kc
	or	
	24C82619C07	VIO; incl 1K867236 CORE, tuning; 60 kc
	NON-REFERENCED ITEMS	
	1V80734A83	455 kc Printed Circuit Board
	26B82679C01	SHIELD, coil; used on L12 and T5

NOTE:

Replacement diodes and transistors must be ordered by Motorola part number only for optimum performance.


Z1
TFN6017CS
455 KC FILTER
(USED FOR SPLIT CHANNEL ONLY)
R54
680
WHT
A+ 13.6V
FROM 455KC
IF BOARD
R22
1K
Q9
M9357
4.0V
BRN
BLK
C41
.01UF
0.65V
0V
R20
120K
R21
4.7K
C42
.05UF
C78
0.1UF
BLK
BRN
TO 455 KC
IF AMPL.-I
Q10
BEPD-21494-0


C42
C78
BLK
R21
R54
R22
R20
Q9
C41
WHT
ORG
BLU
OL-AEPD-21492-0
A+
FROM
455KC IF
INPUT
FROM
FILTER
INPUT COILS
OUTPUT
TO FILTER
OUTPUT
COILS

PARTS LIST SHOWN ON
BACK OF THIS DIAGRAM

455 KC Filter Amplifier
Circuit Board Detail
Motorola No. EPD-21493-O
8/28/68-RS

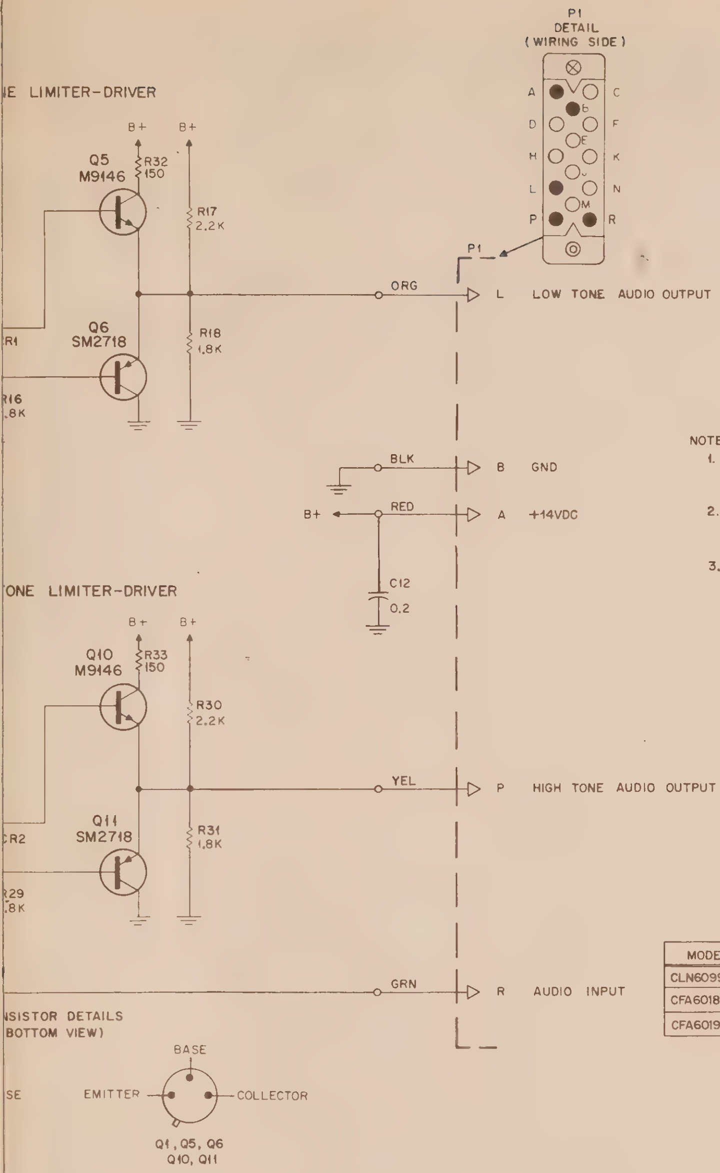
PARTS LIST

1V80763A41 455 KC Filter Amplifier Board EPD-21495-O

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
		CAPACITOR, fixed: uf
C41	21C82428B06	.01 +70-30%; 100 v
C42	21C82372C07	.05 +80-20%; 25 v
C78	21C82372C01	0.1; 25 v
		TRANSISTOR (SEE NOTE)
Q9	48R869357	P-N-P; type M9357
		RESISTOR, fixed ±10%; 1/4 w
R20	6S128987	120K
R21	6S127804	4.7K
R22	6S127802	1K
R54	6S128599	680
NON-REFERENCED ITEM		
	1V80763A42	CIRCUIT BOARD ASS'Y. (eyeleted)

NOTE:

Replacement transistors must be ordered by Motorola part number only for optimum performance.


P1
DETAIL
(WIRING SIDE)
A
C
b
D
F
E
H
K
L
N
M
P
R
P1
E LIMITER-DRIVER
B+
B+
Q5
M9146
R32
150
R17
2.2K
ORG
L
LOW TONE AUDIO OUTPUT
Q6
SM2718
R1
R18
1.8K
R16
.8K
BLK
B
GND
B+
RED
A
+14VDC
C12
0.2
ONE LIMITER-DRIVER
B+
B+
Q10
M9146
R33
150
R30
2.2K
YEL
P
HIGH TONE AUDIO OUTPUT
Q11
SM2718
R2
R31
1.8K
R29
.8K
GRN
R
AUDIO INPUT
SISTOR DETAILS
BOTTOM VIEW)
BASE
SE
EMITTER
COLLECTOR
Q1, Q5, Q6
Q10, Q11

NOTES.

1. UNLESS OTHERWISE SPECIFIED:
   ALL CAPACITOR VALUES ARE IN MICROFARADS
   ALL RESISTOR VALUES ARE IN OHMS; K=1000
2. ALL VOLTAGE READINGS ARE REFERENCED TO GND. DC READINGS TAKEN WITH A MOTOROLA DC VOLTMETER OR AC VOLTMETER AS APPROPRIATE.
3. NOT ON CIRCUIT BOARD.

DIAGRAM NO 63D81039A43-A

MODEL TABLE

MODEL	SUFFIX	DESCRIPTION
CLN6099B	1	DRIVER & LIMITER BOARD
CFA6018A		HIGH PASS FILTER
CFA6019A		LOW PASS FILTER

PREVIOUS REVISIONS AND PARTS LIST
SHOWN ON BACK OF THIS DIAGRAM

CLN1002B Driver-Limiter and Filter Kit
Schematic Diagram and Circuit Board Detail
Motorola No. EPD-15708-B
8/28/68-RS

PARTS LIST

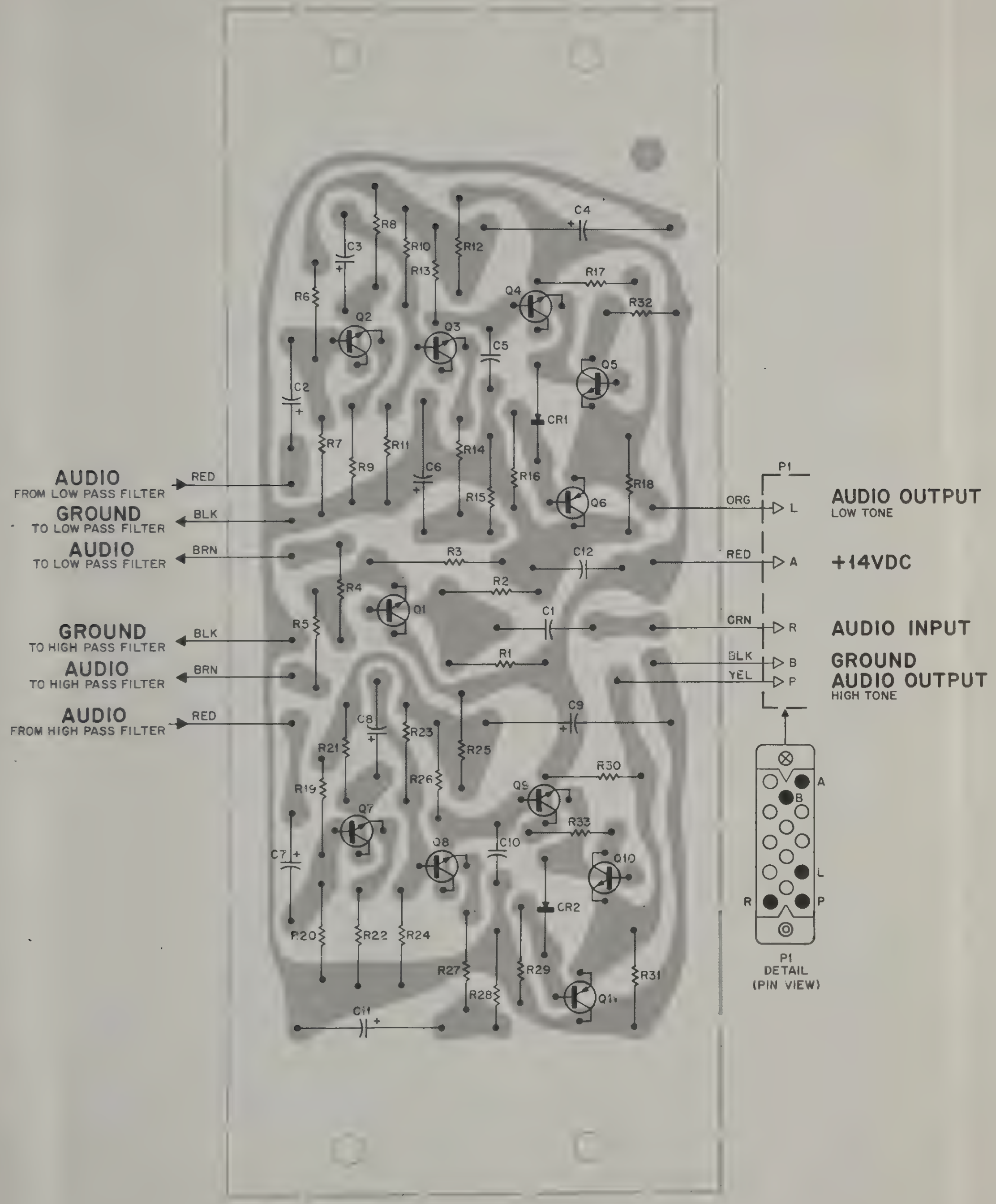
1V80763A41 455 KC Filter Amplifier Board EPD-21495-O

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
		CAPACITOR, fixed: uf
C41	21C82428B06	.01 +70-30%; 100 v
C42	21C82372C07	.05 +80-20%; 25 v
C78	21C82372C01	0.1; 25 v
		TRANSISTOR (SEE NOTE)
Q9	48R869357	P-N-P; type M9357
		RESISTOR, fixed ±10%; 1/4 w
R20	6S128987	120K
R21	6S127804	4.7K
R22	6S127802	1K
R54	6S128599	680
NON-REFERENCED ITEM		
	1V80763A42	CIRCUIT BOARD ASS'Y. (eyeleted)

NOTE:

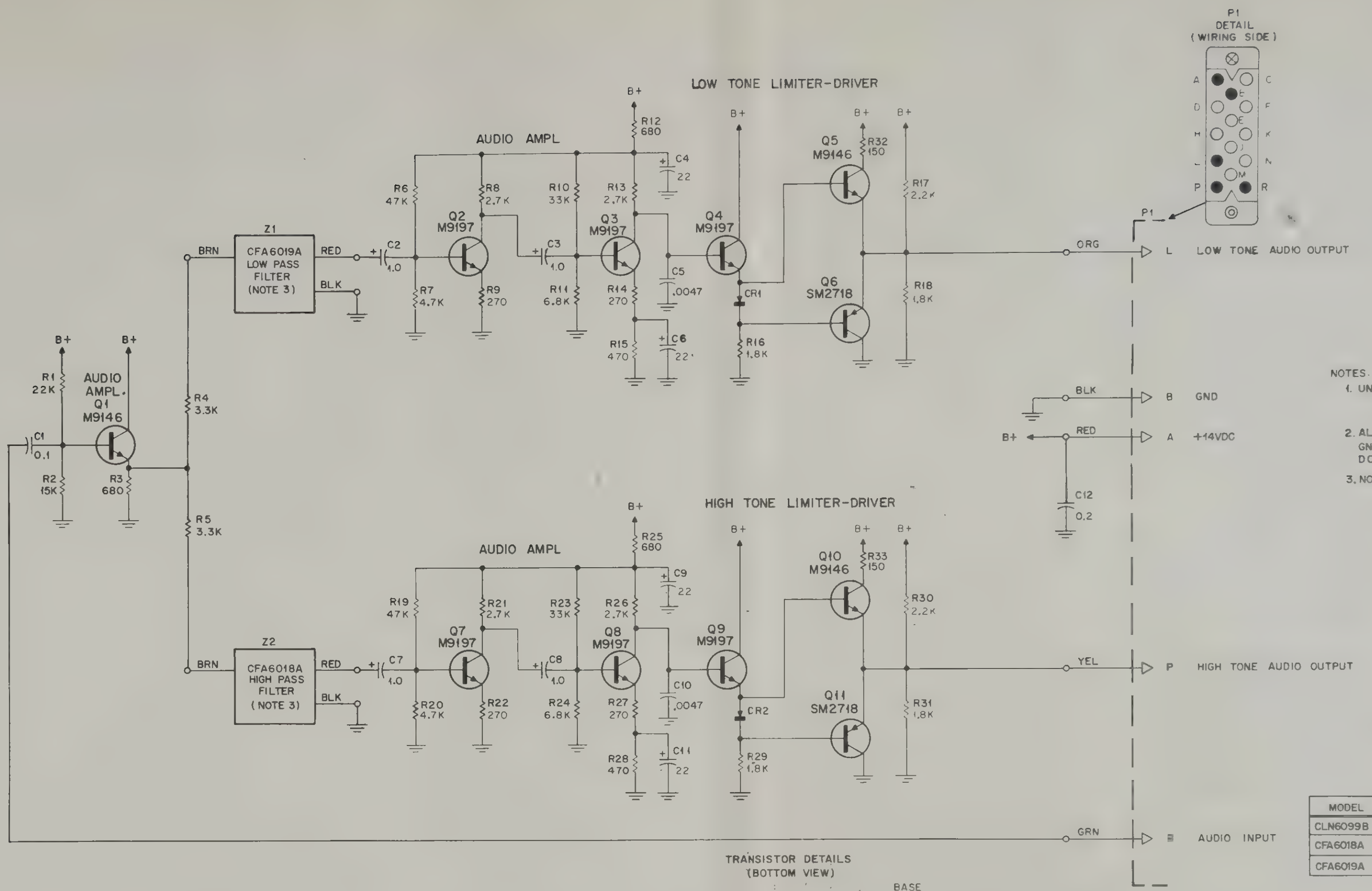
Replacement transistors must be ordered by Motorola part number only for optimum performance.

COMPONENT SIDE


C3
R8
R10
R12
C4
R13
R6
Q2
Q3
Q4
R17
R32
C5
Q5
C2
CR1
R7
R9
R11
R14
C6
R16
R15
R18
Q6
AUDIO
FROM LOW PASS FILTER
RED
GROUND
TO LOW PASS FILTER
BLK
AUDIO
TO LOW PASS FILTER
BRN
R3
C12
R4
Q1
R2
R5
C1
R1
GROUND
TO HIGH PASS FILTER
BLK
AUDIO
TO HIGH PASS FILTER
BRN
AUDIO
FROM HIGH PASS FILTER
RED
C9
C8
R21
R23
R25
R30
R19
R26
Q9
Q7
R33
Q8
C10
Q10
C7
CR2
R20
R22
R24
R27
R29
R31
R28
Q11
C11
P1
ORG
L
AUDIO OUTPUT
LOW TONE
RED
A
+14VDC
GRN
R
AUDIO INPUT
BLK
B
GROUND
YEL
P
AUDIO OUTPUT
HIGH TONE
A
B
L
R
P

P1
DETAIL
(PIN VIEW)

8D-DEPD-21533-O
OL-DEPD-21534-O


P1
DETAIL
(WIRING SIDE)
A
C
E
D
F
H
K
J
L
N
M
P
R
LOW TONE LIMITER-DRIVER
AUDIO AMPL
B+
R12
680
C4
22
R6
47K
R8
2.7K
R10
33K
R13
2.7K
Q2
M9197
Q3
M9197
Q4
M9197
Q5
M9146
R32
150
R17
2.2K
Z1
CFA6019A
LOW PASS
FILTER
(NOTE 3)
BRN
RED
BLK
C2
1.0
C3
1.0
C5
.0047
CR1
Q6
SM2718
R18
1.8K
R7
4.7K
R9
270
R11
6.8K
R14
270
R15
470
C6
22
R16
1.8K
P1
ORG
L
LOW TONE AUDIO OUTPUT
R1
22K
AUDIO
AMPL.
Q1
M9146
C1
0.1
R2
15K
R3
680
R4
3.3K
R5
3.3K
BLK
B
GND
B+
RED
A
+14VDC
C12
0.2
HIGH TONE LIMITER-DRIVER
AUDIO AMPL
R25
680
C9
22
R19
47K
R21
2.7K
R23
33K
R26
2.7K
Q7
M9197
Q8
M9197
Q9
M9197
Q10
M9146
R33
150
R30
2.2K
Z2
CFA6018A
HIGH PASS
FILTER
(NOTE 3)
BRN
RED
BLK
C7
1.0
C8
1.0
C10
.0047
CR2
Q11
SM2718
R31
1.8K
R20
4.7K
R22
270
R24
6.8K
R27
270
R28
470
C11
22
R29
1.8K
YEL
P
HIGH TONE AUDIO OUTPUT
GRN
R
AUDIO INPUT

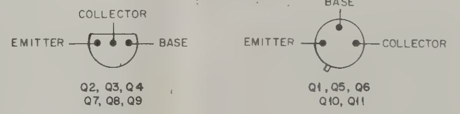
NOTES.
1. UNLESS OTHERWISE SPECIFIED:
   ALL CAPACITOR VALUES ARE IN MICROFARADS
   ALL RESISTOR VALUES ARE IN OHMS; K=1000
2. ALL VOLTAGE READINGS ARE REFERENCED TO GND. DC READINGS TAKEN WITH A MOTOROLA DC VOLTMETER OR AC VOLTMETER AS APPROPRIATE.
3. NOT ON CIRCUIT BOARD.

DIAGRAM NO 63D81039A43-A

MODEL TABLE

MODEL	SUFFIX	DESCRIPTION
CLN6099B	1	DRIVER & LIMITER BOARD
CFA6018A		HIGH PASS FILTER
CFA6019A		LOW PASS FILTER

TRANSISTOR DETAILS
(BOTTOM VIEW)


COLLECTOR
EMITTER
BASE
Q2, Q3, Q4
Q7, Q8, Q9
BASE
EMITTER
COLLECTOR
Q1, Q5, Q6
Q10, Q11

VOLTAGE READINGS

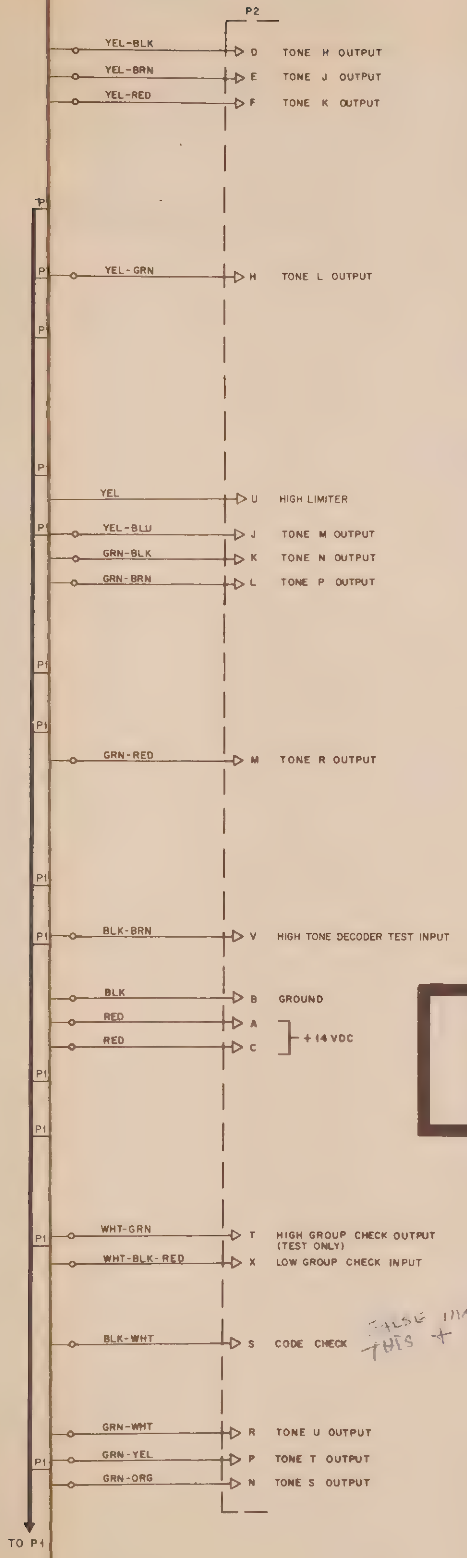
TRANSISTOR OR REFERENCE POINT	EMITTER	COLLECTOR	BASE	OTHER	SIGNAL CONDITION
Q1	3.9	13.6	4.5		DC
	0.81	0	0.82		AC
Q2	0.4	7.5	1.0		DC
	0.27	1.6	0.30		AC
Q3	1.3	7.3	1.1		DC
	0.56	4.6	1.6		AC
Q4, 9	6.7	13.6	7.3		DC
	4.6	0	4.6		AC
Q5, 10	6.4	13.6	6.7		DC
	4.2	0	4.6		AC
Q6, 11	6.4	0	6.1		DC
	4.2	0	4.6		AC
Q7	0.4	7.5	1.0		DC
	0.3	1.6	0.34		AC
Q8	1.3	7.3	1.1		DC
	0.56	4.6	1.6		AC
INPUT OF HIGH PASS FILTER	-	-	-	0.39	DC
	-	-	-	0.37	AC
INPUT OF LOW PASS FILTER	-	-	-	0.39	DC
	-	-	-	0.54	AC
ANODE OF C4, C9	-	-	-	11.5	DC
	-	-	-	0	AC
ANODE OF C6, C11	-	-	-	0.8	DC
	-	-	-	0	AC

NOTE: ALL VOLTAGE READINGS ARE
REFERENCED TO GROUND.

EPD-13994-O

PREVIOUS REVISIONS AND PARTS LIST
SHOWN ON BACK OF THIS DIAGRAM

CLN1002B Driver-Limiter and Filter Kit
Schematic Diagram and Circuit Board Detail
Motorola No. EPD-15708-B
8/28/68-RS


P2
YEL-BLK
D
TONE H OUTPUT
YEL-BRN
E
TONE J OUTPUT
YEL-RED
F
TONE K OUTPUT
P
P1
YEL-GRN
H
TONE L OUTPUT
YEL
U
HIGH LIMITER
YEL-BLU
J
TONE M OUTPUT
GRN-BLK
K
TONE N OUTPUT
GRN-BRN
L
TONE P OUTPUT
GRN-RED
M
TONE R OUTPUT
BLK-BRN
V
HIGH TONE DECODER TEST INPUT
BLK
B
GROUND
RED
A
RED
C
+14 VDC
WHT-GRN
T
HIGH GROUP CHECK OUTPUT (TEST ONLY)
WHT-BLK-RED
X
LOW GROUP CHECK INPUT
BLK-WHT
S
CODE CHECK
FALSE MAKES THIS +
GRN-WHT
R
TONE U OUTPUT
GRN-YEL
P
TONE T OUTPUT
GRN-ORG
N
TONE S OUTPUT
TO P1

E STATED.
UES ARE MICROFARADS.
UES ARE IN OHMS, K=1000.
INGS ARE REFERENCED TO
GES TAKEN WITH A MOTOROLA

VOLTAGE READINGS

TRANSISTOR	BASE	EMITTER	COLLECTOR	SIGNAL CONDITION
Q1, 5, 9, 13, 17, 21, 25, 29, 33, 37, 41	0 0	0 .05	7.4 6.8	STATIC DYNAMIC
Q2, 6, 10, 14, 18, 22, 26, 30, 34, 38, 42	3.3 3.1	2.6 2.5	2.7 3.7	STATIC DYNAMIC
Q3, 7, 11, 15, 19, 23, 27, 31, 35, 39, 43	2.0 2.0	2.6 2.5	13.6 12.2	STATIC DYNAMIC
Q4, 8, 12, 16, 20, 24, 28, 32, 36, 40, 44	13.6 12.2	12.6 10.8	0 0	STATIC DYNAMIC
Q45	2.7 3.4	3.3 4.0	0 11v 0	STATIC DYNAMIC
Q46	3.3 3.0 4.0	3.8 3.8	13.1 13.1	STATIC DYNAMIC
Q47	4.6 4.6	3.8 3.8	4.0 4.0	STATIC DYNAMIC
Q48, 49, 50, 51	3.7 8.2	3.1 7.6	13.6 13.6	STATIC DYNAMIC

NOTE
ALL VOLTAGE READINGS ARE REFERENCED TO GROUND.

EPD-21782-O

In the VOLTAGE READINGS table the following two voltages are listed for each measuring point.

STATIC - Refers to the voltage appearing when there is no command being sent from the control transmitter unit.

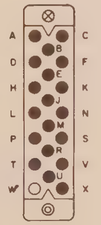
DYNAMIC - Refers to the voltage appearing when a command is being sent that directly causes the circuit under test to respond normally.

NOTE
Both readings are taken with the same meter (Motorola Model S1052B) and the DYNAMIC reading at some points may be an average reading of a pulsing voltage, while at other points may be a steady voltage.

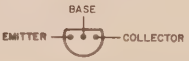
EPD-15607-O

FOR UNITS SUFFIXED EARLIER THAN INDICATED REFER TO SCHEMATIC DIAGRAM PEPD-17619-O.

EPD-22078-O


A
B
C
D
E
F
H
J
K
L
M
N
P
R
S
T
U
V
W
X

P2
DETAIL
(WIRING SIDE)


BASE
EMITTER
COLLECTOR

TRANSISTOR DETAIL
(BOTTOM VIEW)

PARTS LIST SHOWN ON
BACK OF THIS DIAGRAM

CLN6090B-1 High Frequency Tone Decoder
Schematic Diagram and Circuit Board Detail
Motorola No. PEPD-21694-O
8/28/68-RS

REVISIONS

DIAG. ISSUE	BOARD AND SUFFIX NO.	REF. SYMBOL	CHANGE	LOCATION
A		C5, 10	WERE 21D82428B11	PARTS LIST
B	CLN6099B-1	C5, 10	WERE 21D82428B58	

PARTS LIST

CLN6099B Driver & Limiter Circuit Board EPD-13993-B

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
		CAPACITOR, fixed: uf ±10%; 25 v; unl stated
C1	8D82905G07,	0.1
	or8D83293B11	0.1; 50 v
C2, 3, 7, 8	23D82783B14	1; 15 v
C4, 9	23K867384	22
C5, 10	21D82428B56	.0047; 200 v
C6, 11	23D82783B18	22 ±20%; 6 v
C12	21C82372C02	0.2 +80-20%
		SEMICONDUCTOR DEVICE, diode: SEE NOTE
CR1, 2	48C82392B03	silicon
		CONNECTOR, plug:
P1	1V80765A79	assy; male; 14 cont. incl. 14A83102B03 INSULATOR, conn. 42A83312D01 CLIP, conn. (2 req'd.); 36A83313D01 KNOB (2 req'd.); 22B82637B02 PIN, drive (2 req'd.) 3A83275D05 JACKSCREW (male) and 3A83275D06 JACKSCREW (female)
		TRANSISTOR: SEE NOTE
Q1, 5, 10	48R869146	N-P-N; type M9146
Q2, 3, 4, 7, 8, 9	48R869197	N-P-N; type M9197
Q6, 11	48R869145	P-N-P; type SM2718
		RESISTOR, fixed: ±5%; 1/4 w; unl stated
R1	6S129667	22K
R2	6S129236	15K
R3	6S5651	680; 1/2 w
R4, 5	6S129981	3.3K
R6, 19	6S131527	47K
R7, 20	6S129669	4.7K
R8, 13, 21, 26	6S129707	2.7K
R9, 14, 22, 27	6S131525	270
R10, 23	6S129526	33K
R11, 24	6S129237	6.8K
R12, 25	6K129984	680
R15, 28	6S129709	470
R16, 18, 29, 31	6S129820	1.8K
R17, 30	6S129804	2.2K
R32, 33	6S131276	150

Filter EPD-11726-A

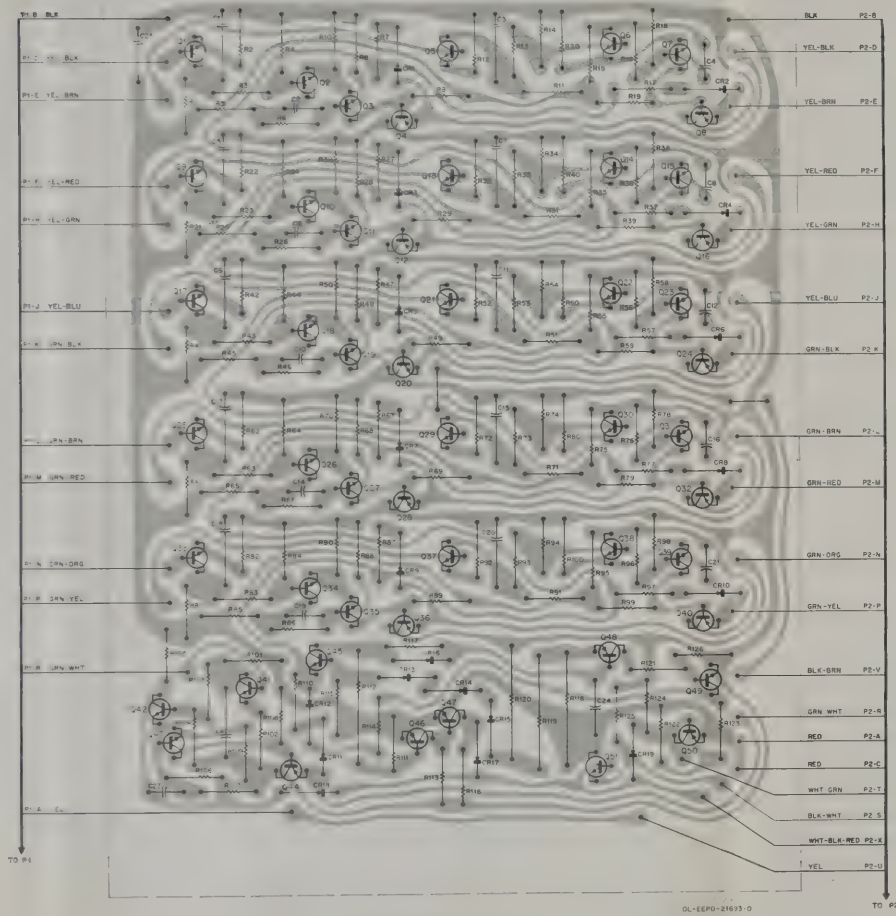
		FILTER, AF:
Z1	CFA6019A	low pass; cutoff freq. 1300 cps

Filter EPD-11727-O

		FILTER, AF:
Z2	CFA6018A	high pass; cutoff freq. 1500 cps

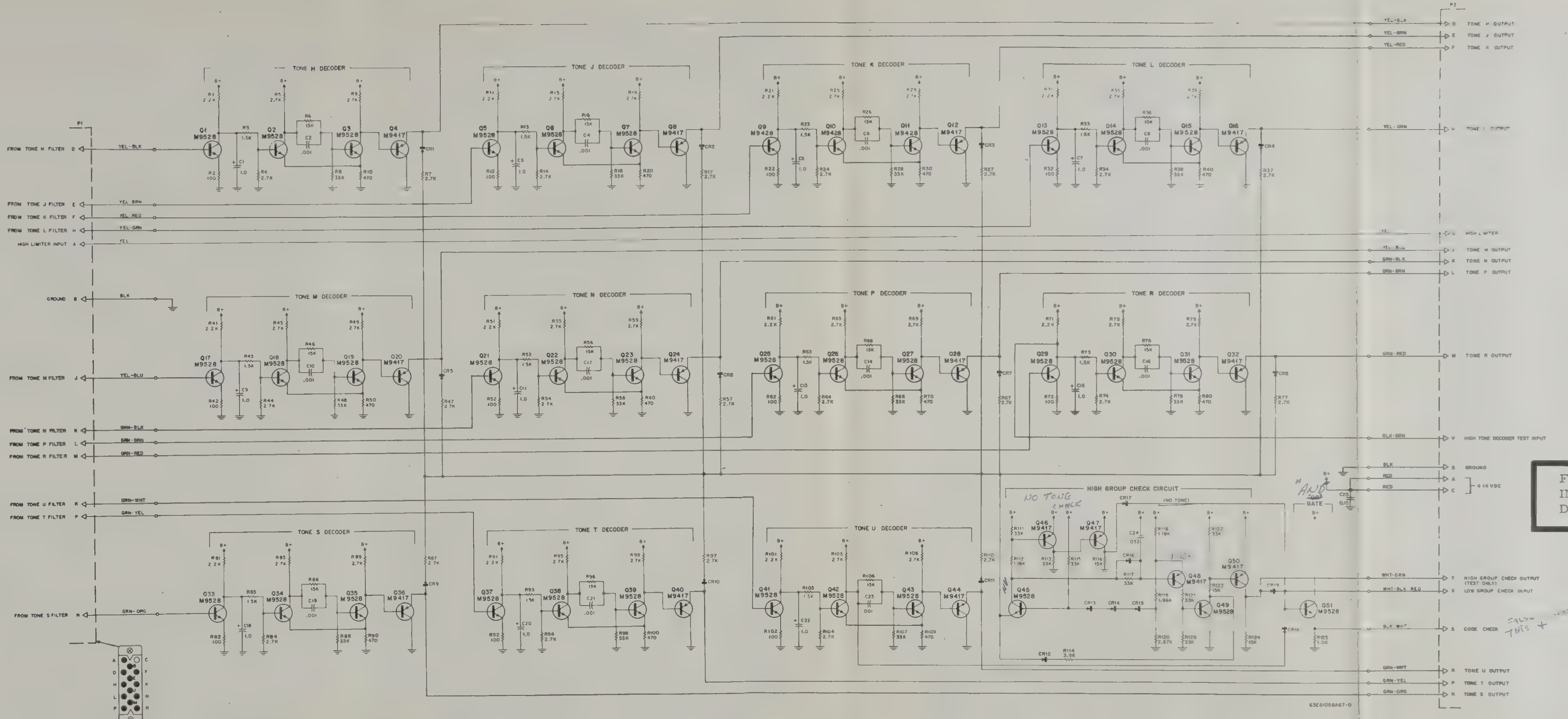
NOTE:

Replacement transistors and diodes must be ordered by Motorola part number only for optimum performance.



TO P1
TO P2
OL-EEPD-21695-O

COMPONENT SIDE



TONE H DECODER
TONE J DECODER
TONE K DECODER
TONE L DECODER
TONE M DECODER
TONE N DECODER
TONE P DECODER
TONE R DECODER
TONE S DECODER
TONE T DECODER
TONE U DECODER
HIGH GROUP CHECK CIRCUIT
FROM TONE H FILTER
FROM TONE J FILTER
FROM TONE K FILTER
FROM TONE L FILTER
HIGH LIMITER INPUT
GROUND
FROM TONE M FILTER
FROM TONE N FILTER
FROM TONE P FILTER
FROM TONE R FILTER
FROM TONE U FILTER
FROM TONE T FILTER
FROM TONE S FILTER
TONE K OUTPUT
TONE J OUTPUT
TONE V OUTPUT
TONE L OUTPUT
HIGH LIMITER
TONE H OUTPUT
TONE M OUTPUT
TONE P OUTPUT
TONE R OUTPUT
HIGH TONE DECODER TEST INPUT
GROUND
+14 VDC
HIGH GROUP CHECK OUTPUT (TEST ONLY)
LOW GROUP CHECK INPUT
CODE CHECK
TONE U OUTPUT
TONE T OUTPUT
TONE S OUTPUT
P1 DETAIL (WIRING SIDE)
NO TONE CHECK
AND GATE
63E81058A67-O

MODEL TABLE

MODEL	SUFFIX	DESCRIPTION
CLN6090B-2		HIGH TONE DECODER CIRCUIT BOARD

NOTES:

1. UNLESS OTHERWISE STATED
   CAPACITOR VALUES ARE MICROFARADS
   RESISTOR VALUES ARE IN OHMS, K=1000
2. ALL VOLTAGE READINGS ARE REFERENCED TO GROUND, DC VOLTAGES TAKEN WITH A MOTOROLA DC VOLTMETER.

VOLTAGE READINGS

TRANSISTOR	BASE	EMITTER	COLLECTOR	SIGNAL CONDITION
Q1, 5, 9, 13, 17, 21, 25, 29, 33, 37, 41	0	0	7.4	STATIC
	0	.05	6.8	DYNAMIC
Q2, 6, 10, 14, 18, 22, 26, 30, [illegible]	3.3	2.6	2.7	STATIC
	3.1	2.5	3.7	DYNAMIC
Q3, 7, 11, 15, 19, 23, 27, 31, [illegible]	[illegible]	[illegible]	3.6	STATIC
	[illegible]	[illegible]	12.2	DYNAMIC
Q4, [illegible] 20, 24, 28, 32, 36, 40, 44	[illegible]	[illegible]	[illegible]	STATIC
	12.2	10.8	0	DYNAMIC
Q45	2.7	3.3	0	STATIC
	3.4	4.0	0	DYNAMIC
Q46	3.3	3.8	13.1	STATIC
	4.0	3.8	13.1	DYNAMIC
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
	4.6	3.8	4.[illegible]	[illegible]
[illegible]	.7	3.1	13.6	[illegible]
	8.2	7.6	13.6	DYNAMIC

ALL VOLTAGE READINGS ARE REFERENCED TO GROUND.

EPD-21782-O

In the VOLTAGE READINGS table the following two voltages are listed for each measuring point.

STATIC - Refers to the voltage appearing when there is no command being sent from the control transmitter unit.

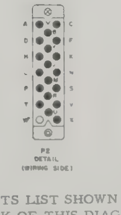
DYNAMIC - Refers to the voltage appearing when a command is being sent that directly causes the circuit under test to respond normally.

NOTE

Both readings are taken with the same meter (Motorola [illegible] S1052B) and the DYNAMIC reading at some points may be an average reading of a pulsing voltage, while at other points may be a steady voltage.

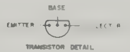
FOR UNITS SUFFIXED EARLIER THAN INDICATED REFER TO SCHEMATIC DIAGRAM PEPD-17619-O.

EPD-22078-O



A
B
C
D
E
F
H
J
K
L
M
N
P
R
S
T
U
V
W
X

P2 DETAIL (WIRING SIDE)

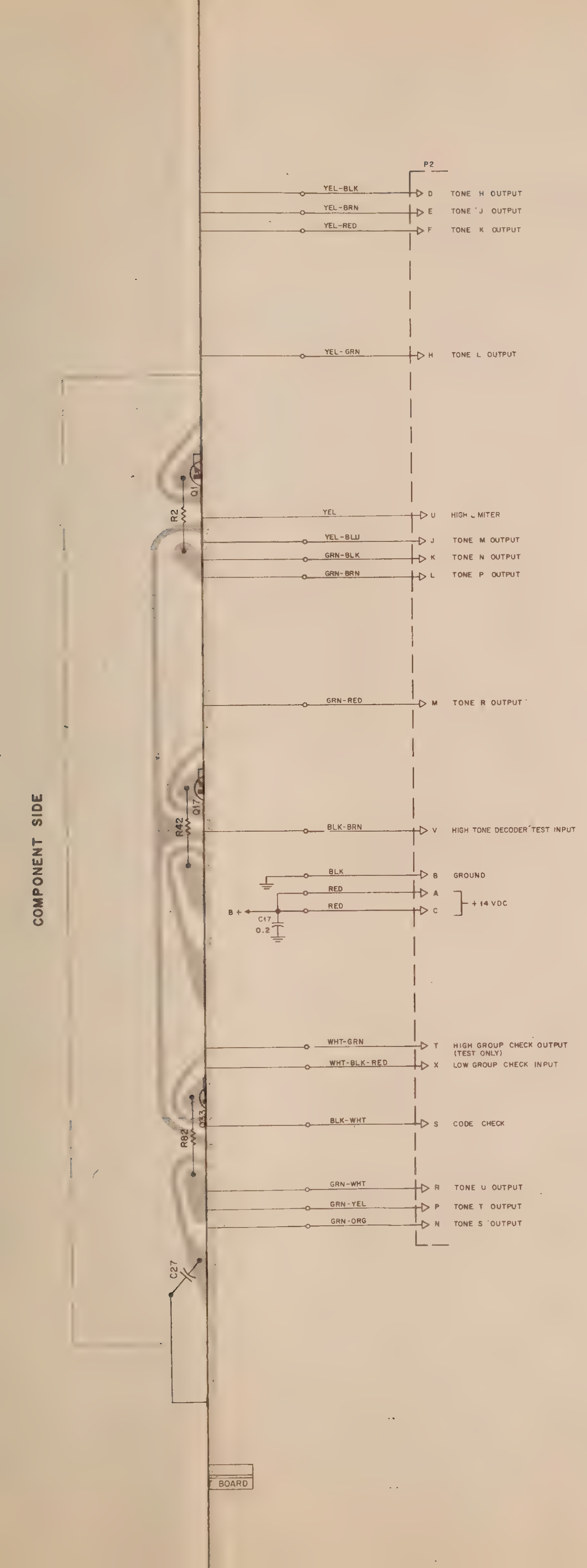


BASE
EMITTER
COLLECTOR

TRANSISTOR DETAIL (BOTTOM VIEW)

PARTS LIST SHOWN ON
BACK OF THIS DIAGRAM

CLN6090B-1 High Frequency Tone Decoder
Schematic Diagram and Circuit Board Detail
Motorola No. PEPD-21694-O
8/28/68-RS


COMPONENT SIDE
Q1
R2
Q17
R42
Q33
R82
C27
BOARD
P2
YEL-BLK
D
TONE H OUTPUT
YEL-BRN
E
TONE J OUTPUT
YEL-RED
F
TONE K OUTPUT
YEL-GRN
H
TONE L OUTPUT
YEL
U
HIGH LIMITER
YEL-BLU
J
TONE M OUTPUT
GRN-BLK
K
TONE N OUTPUT
GRN-BRN
L
TONE P OUTPUT
GRN-RED
M
TONE R OUTPUT
BLK-BRN
V
HIGH TONE DECODER TEST INPUT
BLK
B
GROUND
RED
A
RED
C
+ 14 VDC
B +
C17
0.2
WHT-GRN
T
HIGH GROUP CHECK OUTPUT (TEST ONLY)
WHT-BLK-RED
X
LOW GROUP CHECK INPUT
BLK-WHT
S
CODE CHECK
GRN-WHT
R
TONE U OUTPUT
GRN-YEL
P
TONE T OUTPUT
GRN-ORG
N
TONE S OUTPUT

VOLTAGE READINGS

TRANSISTOR	BASE	EMITTER	COLLECTOR	SIGNAL CONDITION
Q1, 5, 9, 13, 17, 21, 25, 29, 33, 37, 41	0	0	7.4	STATIC
	0	.05	6.8	DYNAMIC
Q2, 6, 10, 14, 18, 22, 26, 30, 34, 38, 42	3.3	2.6	2.7	STATIC
	3.1	2.5	3.7	DYNAMIC
Q3, 7, 11, 15, 19, 23, 27, 31, 35, 39, 43	2.0	2.6	13.6	STATIC
	2.0	2.5	12.2	DYNAMIC
Q4, 8, 12, 16, 20, 24, 28, 32, 36, 40	13.6	12.6	0	STATIC
	12.2	10.8	0	DYNAMIC
Q44	2.7	3.3	0	STATIC
	3.4	4.0	0	DYNAMIC
Q45	3.3	3.8	13.1	STATIC
	4.0	3.8	13.1	DYNAMIC
Q46	4.6	3.8	4.0	STATIC
	4.6	3.8	4.0	DYNAMIC
Q47	3.7	3.1	13.6	STATIC
	8.2	7.6	13.6	DYNAMIC

NOTE: ALL VOLTAGE READINGS ARE REFERENCED TO GROUND.

EPD-12236-O

In the VOLTAGE READINGS table the following two voltages are listed for each measuring point.

STATIC - Refers to the voltage appearing when there is no command being sent from the control transmitter unit.

DYNAMIC - Refers to the voltage appearing when a command is being sent that directly causes the circuit under test to respond normally.

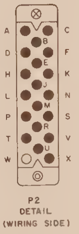
NOTE

Both readings are taken with the same meter (Motorola Model S1052B) and the DYNAMIC reading at some points may be an average reading of a pulsing voltage, while at other points may be a steady voltage.

EPD-15607-O

FOR MODELS SUFFIXED 1 OR LATER REFER TO PEPD-21694-O

EPD-22079-O


A
C
B
D
F
E
H
K
J
L
N
M
P
S
R
T
V
U
W
X
P2
DETAIL
(WIRING SIDE)

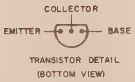

COLLECTOR
EMITTER
BASE
TRANSISTOR DETAIL
(BOTTOM VIEW)

DIAGRAM NO 63E81039A28-A

PREVIOUS REVISIONS AND PARTS LIST SHOWN ON BACK OF THIS DIAGRAM

CLN6090B High Frequency Tone Decoder
Schematic Diagram and Circuit Board Detail
Motorola No. PEPD-17619-A
8/28/68-RS

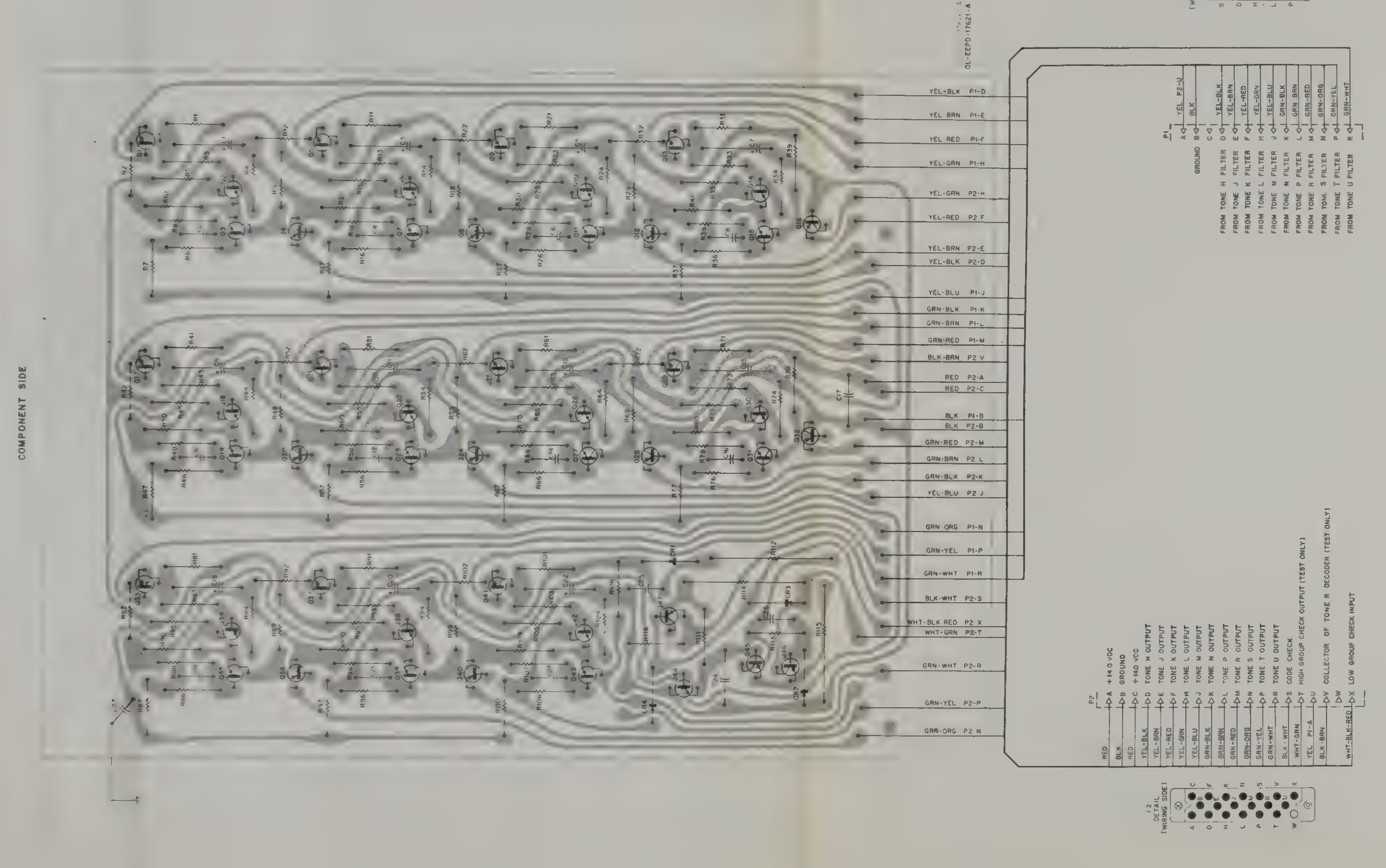
PARTS LIST

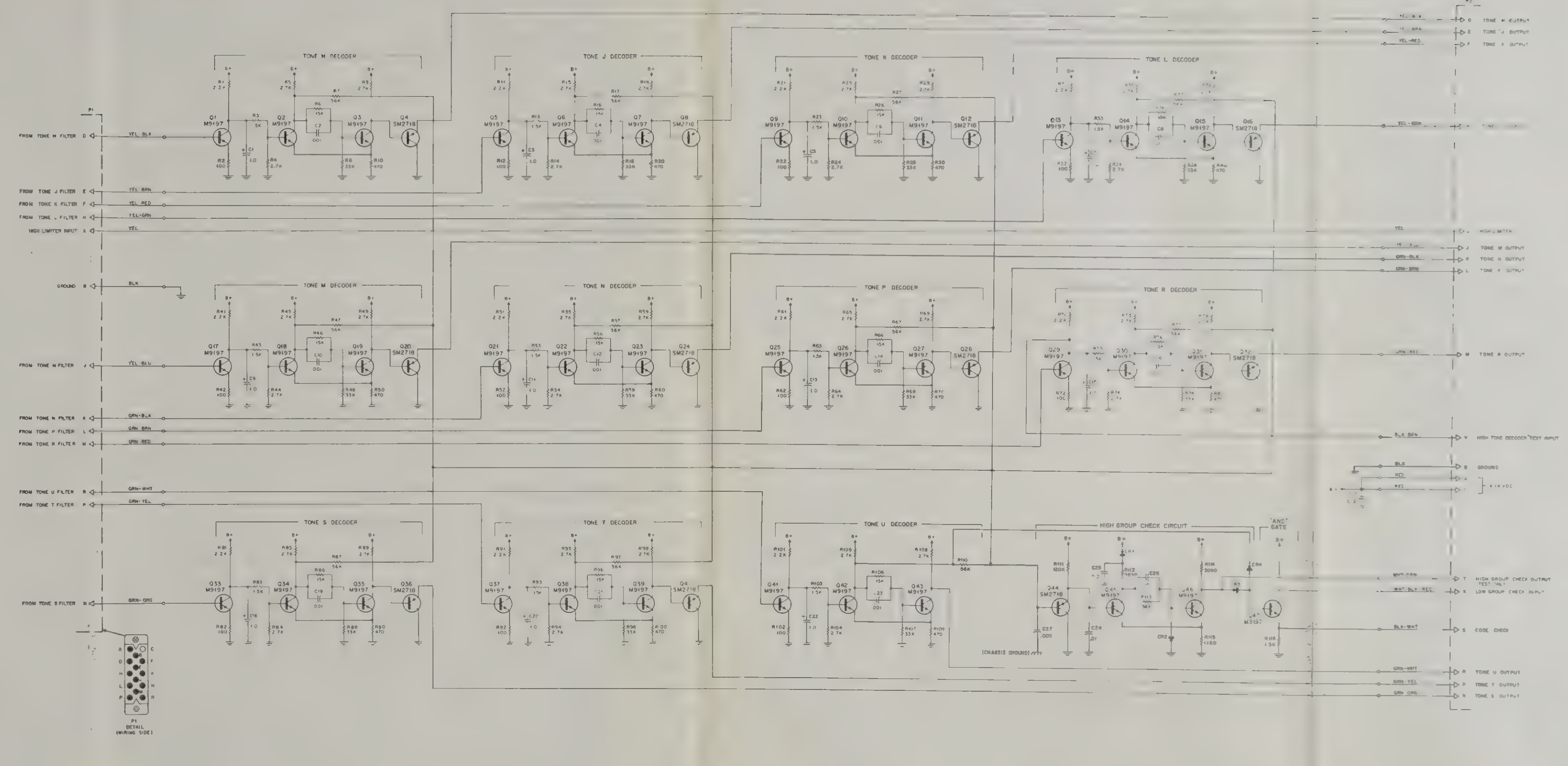
CLN6090B High Tone Decoder Kit EPD-21785-O

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
		CAPACITOR, fixed: uf ±10% 25 v; unl stated
C1, 3, 5, 7, 9, 11, 13, 15, 18, 20, 22	23D82783B14	1; 15 v
C2, 4, 6, 8, 10, 12, 14, 16, 19, 21, 23	21C82187B20	.001; 100 v
C24	8D82905G08	.033 ±10%; 50 v
C25	8D83293B18	.15 ±10%; 50 v
		SEMICONDUCTOR DEVICE, diode: (SEE NOTE)
CR1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19	48C82392B03	silicon
		CONNECTOR, Plug:
P1	1V80765A79	assy; male; 14 cont. incl; 14A83102B03 INSULATOR, conn. 42A83312D01 CLIP, conn. (2 req'd.) 36A83313D01 KNOB (2 req'd.) 22B82637B02 PIN, drive (2 req'd.) 3A83275D05 JACK-SCREW (male) & 3A83275D06 JACKSCREW (female)
P2	1V80765A80	assy; male; 20 cont; incl. 14A83102B01 INSULATOR conn, 42A83312D01 CLIP, conn. (2 req'd.) 36A83313D01 KNOB (2 req'd.) 22B82637B02 PIN, drive (2 req'd.) 3A83275D05 JACK-SCREW (male) & 3A83275D06 JACKSCREW (female)
		TRANSISTOR: (SEE NOTE)
Q1, 2, 3, 5, 6, 7, 9, 10, 11, 13, 14, 15, 17, 18, 19, 21, 22, 23, 25, 26, 27, 29, 30, 31, 33, 34, 35, 37, 38, 39, 41, 42, 43, 45, 49, 51	48R869528	N-P-N; type M9528
Q4, 8, 12, 16, 20, 24, 28, 32, 36, 40, 44, 46, 47, 48, 50	48R869717	P-N-P; type M9417
		RESISTOR, fixed: ±5%; 1/4 w; unl stated
R1, 11, 21, 31, 41, 51, 61, 71, 81, 91, 101	6S129804	2.2K
R2, 12, 22, 32, 42, 52, 62, 72, 82, 92, 102	6S131524	100
R3, 13, 23, 33, 43, 53, 63, 73, 83, 93, 103, 116	6S129681	1.5K
R4, 5, 7, 9, 14, 15, 17, 19, 24, 25, 27, 29, 34, 35, 37, 39, 44, 45, 47, 49, 54, 55, 57, 59, 64, 65, 67, 69, 74, 75, 77, 79, 84, 85, 87, 89, 94, 95, 97, 99, 104, 105, 108, 110,	6K129707	2.7K
R6, 16, 26, 36, 46, 56, 66, 76, 86, 96, 106, 116, 123, 124	6S129236	15K
R8, 18, 28, 38 48, 58, 68, 78, 88, 98, 107, 111, 113, 115, 117, 121, 122, 126	6S129526	33K
R10, 20, 30, 40, 50, 60, 70, 80, 90, 100, 109	6S129709	470
R114	6S129819	3.9K
R112, 118	6D82672B19	1180±1%
R119	6D82672B27	1960±1%
R120	6D82672B17	2670±1%

NOTE:

Replacement transistors and diodes must be ordered by Motorola part number only for optimum performance.


COMPONENT SIDE
YEL-BLK P1-D
YEL-BRN P1-E
YEL-RED P1-F
YEL-GRN P1-H
YEL-GRN P2-H
YEL-RED P2-F
YEL-BRN P2-E
YEL-BLK P2-D
YEL-BLU P1-J
GRN-BLK P1-K
GRN-BRN P1-L
GRN-RED P1-M
BLK-BRN P2-V
RED P2-A
RED P2-C
BLK P1-B
BLK P2-B
GRN-RED P2-M
GRN-BRN P2-L
GRN-BLK P2-K
YEL-BLU P2-J
GRN-ORG P1-N
GRN-YEL P1-P
GRN-WHT P1-R
BLK-WHT P2-S
WHT-BLK-RED P2-X
WHT-GRN P2-T
GRN-WHT P2-R
GRN-YEL P2-P
GRN-ORG P2-N
P1 DETAIL (WIRING SIDE)
P2 DETAIL (WIRING SIDE)


TONE M DECODER
TONE J DECODER
TONE K DECODER
TONE L DECODER
TONE M DECODER
TONE N DECODER
TONE P DECODER
TONE R DECODER
TONE S DECODER
TONE T DECODER
TONE U DECODER
HIGH GROUP CHECK CIRCUIT
AND GATE
FROM TONE H FILTER
FROM TONE J FILTER
FROM TONE K FILTER
FROM TONE L FILTER
HIGH LIMITER INPUT
GROUND
FROM TONE M FILTER
FROM TONE N FILTER
FROM TONE P FILTER
FROM TONE R FILTER
FROM TONE S FILTER
FROM TONE T FILTER
FROM TONE U FILTER
TONE H OUTPUT
TONE J OUTPUT
TONE K OUTPUT
TONE L OUTPUT
TONE M OUTPUT
TONE N OUTPUT
TONE P OUTPUT
TONE R OUTPUT
HIGH TONE DECODER TEST INPUT
GROUND
HIGH GROUP CHECK OUTPUT
LOW GROUP CHECK INPUT
CODE CHECK
TONE S OUTPUT
TONE T OUTPUT
TONE U OUTPUT
MS157
SM2716
P1 DETAIL (WIRING SIDE)

NOTES

1. UNLESS OTHERWISE STATED
   CAPACITOR VALUES ARE MICROFARADS
   RESISTOR VALUES ARE IN OHMS, K=1000
2. ALL VOLTAGE READINGS ARE REFERENCED TO GROUND, DC VOLTAGES TAKEN WITH A MOTOROLA DC VOLTMETER

MODEL TABLE

MODEL	SUFFIX	DESCRIPTION
CLN6090B		HIGH TONE DECODER CIRCUIT BOARD

VOLTAGE READINGS

TRANSISTOR	BASE	EMITTER	COLLECTOR	SIGNAL CONDITION
Q1, 5, 9, 13, 17, 21, 25, 29, [illegible], 41	0	0	7.4	STATIC
	0	.05	6.8	DYNAMIC
Q2, 6, 10, 14, 18, 22, 26, 30, 34, 38, 42	3.3	2.6	2.7	STATIC
	3.1	2.5	3.7	DYNAMIC
Q3, 7, 11, 15, 19, 23, 27, 31, 35, 39, 43	2.0	2.6	13.6	STATIC
	2.0	2.5	12.2	DYNAMIC
Q4, 8, 12, 16, 20, 24, 28, 32, 36, 40	13.6	12.6	0	STATIC
	12.2	10.8	0	DYNAMIC
Q44	2.7	3.3	0	STATIC
	[illegible]	[illegible]	[illegible]	DYNAMIC
Q45	3.3	3.8	13.1	STATIC
	[illegible]	[illegible]	[illegible]	DYNAMIC
Q46	4.6	3.8	4.0	STATIC
	[illegible]	[illegible]	[illegible]	DYNAMIC
Q47	3.7	3.1	13.6	STATIC
	[illegible]	[illegible]	[illegible]	DYNAMIC

NOTE: ALL VOLTAGE READINGS ARE REFERENCED TO GROUND.

In the VOLTAGE READINGS table the following two voltages are listed for each measuring point.

STATIC - Refers to the voltage appearing when there is no command being sent from the control transmitter unit.

DYNAMIC - Refers to the voltage appearing when a command is being sent that directly causes the circuit under test to respond normally.

NOTE

Both readings are taken with the same meter (Motorola Model S1052B) and the DYNAMIC reading at some points may be an average reading of a pulsing voltage, while at other points may be a steady voltage.

EPD-15607-O

FOR MODELS SUFFIXED 1 OR LATER REFER TO PEPD-21694-O

EPD-22079-O

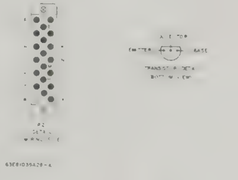


DIAGRAM NO 63E81039A28-A

PREVIOUS REVISIONS AND PARTS LIST SHOWN ON BACK OF THIS DIAGRAM

CLN6090B High Frequency Tone Decoder
Schematic Diagram and Circuit Board Detail
Motorola No. PEPD-17619-A
8/28/68-RS

VOLTAGE READINGS

TRANSISTOR	BASE	EMITTER	COLLECTOR	SIGNAL CONDITION
Q1, 5, 9, 13,	0	0	7.4	STATIC
17, 21, 25	0	.05	6.8	DYNAMIC
Q2, 6, 10, 14,	3.3	2.6	2.7	STATIC
18, 22, 26	3.1	2.5	3.7	DYNAMIC
Q3, 7, 11, 15	2.0	2.6	13.6	STATIC
19, 23, 27	2.0	2.5	12.2	DYNAMIC
Q4, 8, 12, 16	13.6	12.6	0	STATIC
20, 24, 28	12.2	10.8	0	DYNAMIC
Q29	8.2	7.8	13.6	
	8.2	7.5	11.1	
Q30	13.6	13.6	13.0	
	12.8	13.6	13.4	
Q31	13.0	13.6	13.4	
	13.4	13.6	0	
Q32	13.6	10.8	0	
	11.0	10.8	0	
Q33	0	0	13.6	
	0	0	13.6	
Q34	13.6	13.6	0	
	13.6	13.6	0	
Q45	8.2	7.8	13.6	STATIC
	8.2	7.5	11.1	DYNAMIC
Q46	13.6	13.6	13.0	STATIC
	12.8	13.6	13.4	DYNAMIC
Q47	13.0	13.6	13.4	STATIC
	13.4	13.6	0	DYNAMIC
Q48	13.6	10.8	0	STATIC
	11.0	10.8	0	DYNAMIC
Q49	0	0	13.6	STATIC
	0	0	13.6	DYNAMIC
Q50	13.6	13.6	0	STATIC
	13.6	13.6	0	DYNAMIC
Q51	13.0	3.1	13.6	STATIC
	2.4	7.6	13.6	DYNAMIC

EPD-21783-O

FOR UNITS SUFFIXED EARLIER THAN INDICATED REFER TO PEPD-17622.

EPD-22080-O

PARTS LIST SHOWN ON
BACK OF THIS DIAGRAM

CLN6091B-1 Low Frequency Tone Decoder
Schematic Diagram and Circuit Board Detail
Motorola No. PEPD-21695-O
8/28/68-RS

REVISIONS

DIAG. ISSUE	CHASSIS AND SUFFIX NO.	REF. SYMBOL	CHANGE	LOCATION
A	CLN6090B		EXTENSIVE CIRCUIT CHANGES. REFER TO PEPD-21694-O	

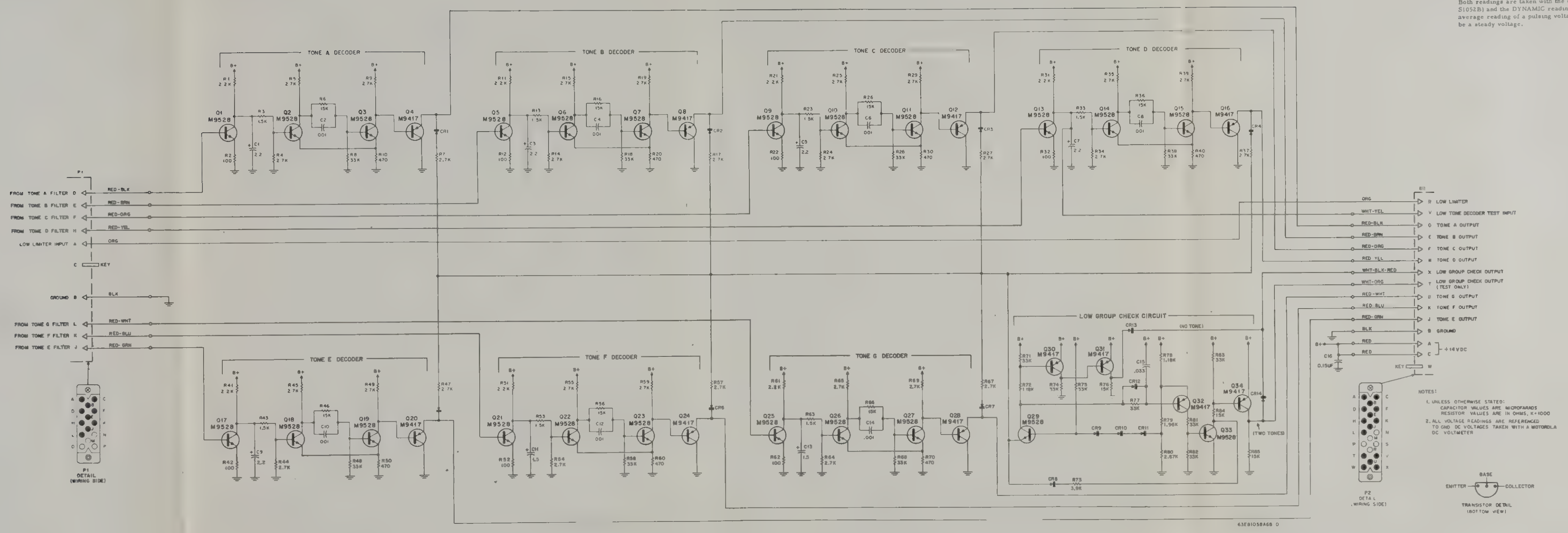
PARTS LIST

CLN6090B High Tone Decoder Kit EPD-13891-A

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
		CAPACITOR, fixed: uf ±10% 25 v; unl stated
C1, 3, 5, 7, 9, 11, 13, 15, 18, 20, 22	23D82783B14	1; 15 v
C2, 4, 6, 8, 10, 12, 14, 16, 19, 21, 23	21C82187B20	.001; 100 v
C17	21C82372C02	0.2 +80-20%
C24	8D82905G01 or 8D83293B06	.01 .01; 50 v
C25	21C82372C05	0.2 +80-20%
C26	21C82372C04	.05 +80-20%
C27	21K857481	.005 ±5%; 100 v
		SEMICONDUCTOR DEVICE, diode: (SEE NOTE)
CR1, 2, 3, 4	48C82392B03	silicon
		CONNECTOR, Plug:
P1	1V80765A79	assy; male; 14 cont. incl; 14A83102B03 INSULATOR, conn. 42A83312D01 CLIP, conn. (2 req'd.) 36A83313D01 KNOB (2 req'd.) 22B82637B02 PIN, drive (2 req'd.) 3A83275D05 JACKSCREW (male) & 3A83275D06 JACKSCREW (female)
P2	1V80765A80	assy; male; 20 cont; incl. 14A83102B01 INSULATOR conn, 42A83312D01 CLIP, conn. (2 req'd.) 36A83313D01 KNOB (2 req'd.) 22B82637B02 PIN, drive (2 req'd.) 3A83275D05 JACKSCREW (male) & 3A83275D06 JACKSCREW (female)
		TRANSISTOR: (SEE NOTE)
Q1, 2, 3, 5, 6, 7, 9, 10, 11, 13, 14, 15, 17, 18, 19, 21, 22, 23, 25, 26, 27, 29, 30, 31, 33, 34, 35, 37, 38, 39, 41, 42, 43, 45, 46, 47	48R869197	N-P-N; type M9197
Q4, 8, 12, 16, 20, 24, 28, 32, 36, 40, 44	48R869145	P-N-P; type SM2718
		RESISTOR, fixed: ±5%; 1/4 w; unl stated
R1, 11, 21, 31, 41, 51, 61, 71, 81, 91, 101	6S129804	2.2K
R2, 12, 22, 32, 42, 52, 62, 72, 82, 92, 102	6S131524	100
R3, 13, 23, 33, 43, 53, 63, 73, 83, 93, 103, 116	6S129681	1.5K
R4, 5, 9, 14, 15, 19, 24, 25, 29, 34, 35, 39, 44, 45, 49, 54, 55, 59, 64, 65, 69, 74, 75, 79, 84, 85, 89, 94, 95, 99, 104, 105, 108	6K129707	2.7K
R6, 16, 26, 36, 46, 56, 66, 76, 86, 96, 106	6S129236	15K
R7, 17, 27, 37, 47, 57, 67, 77, 87, 97, 110, 113	6S128684	56K
R8, 18, 28, 38, 48, 58, 68, 78, 88, 98, 107	6S129526	33K
R10, 20, 30, 40, 50, 60, 70, 80, 90, 100, 109	6S129709	470
R111	6S131446	120K
R112	6D82672B37	3830 ±1%
R114	6D82672B36	3090 ±1%
R115	6D82672B19	1180 ±1%

NOTE:

Replacement transistors and diodes must be ordered by Motorola part number only for optimum performance.


TONE A DECODER
TONE B DECODER
TONE C DECODER
TONE D DECODER
TONE E DECODER
TONE F DECODER
TONE G DECODER
LOW GROUP CHECK CIRCUIT
(NO TONE)
(TWO TONES)
M9528
M9417
P1
FROM TONE A FILTER D
FROM TONE B FILTER E
FROM TONE C FILTER F
FROM TONE D FILTER H
LOW LIMITER INPUT A
C KEY
GROUND B
FROM TONE G FILTER L
FROM TONE F FILTER K
FROM TONE E FILTER J
RED-BLK
RED-BRN
RED-ORG
RED-YEL
ORG
BLK
RED-WHT
RED-BLU
RED-GRN
P1 DETAIL (WIRING SIDE)
LOW LIMITER
LOW TONE DECODER TEST INPUT
TONE A OUTPUT
TONE B OUTPUT
TONE C OUTPUT
TONE D OUTPUT
LOW GROUP CHECK OUTPUT
LOW GROUP CHECK OUTPUT (TEST ONLY)
TONE G OUTPUT
TONE F OUTPUT
TONE E OUTPUT
GROUND
+14VDC
WHT-YEL
WHT-BLK-RED
WHT-ORG
RED
B+
C16 0.15UF
KEY W
P2 DETAIL (WIRING SIDE)
BASE
EMITTER
COLLECTOR
TRANSISTOR DETAIL (BOTTOM VIEW)
63E81058A68 0

NOTES:

1. UNLESS OTHERWISE STATED:
   CAPACITOR VALUES ARE MICROFARADS
   RESISTOR VALUES ARE IN OHMS, K=1000
2. ALL VOLTAGE READINGS ARE REFERENCED TO GND DC VOLTAGES TAKEN WITH A MOTOROLA DC VOLTMETER

MODEL TABLE

MODEL	SUFFIX	DESCRIPTION
CLN6091B-2		LOW TONE DECODER CIRCUIT BOARD

In the VOLTAGE READINGS table the following two voltages are listed for each measuring point.

STATIC - Refers to the voltage appearing when there is no command being sent from the control transmitter unit.

DYNAMIC - Refers to the voltage appearing when a command is being sent that directly causes the circuit under test to respond normally.

NOTE

Both readings are taken with the same meter (Motorola Model S1052B) and the DYNAMIC reading at some points may be an average reading of a pulsing voltage, while at other points may be a steady voltage.

EPD-15607-O

VOLTAGE READINGS

TRANSISTOR	BASE	EMITTER	COLLECTOR	SI CONDITION
Q1, 5, 9, 13,	0	0	7.4	STATIC
17, 21, 25	0	.05	6.8	DYNAMIC
Q2, 6, 10, 14,	3.3	2.6	2.7	STATIC
18, 22, 26	3.1	2.5	[illegible]	[illegible]
Q31	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	13.1	[illegible]

FOR UNITS SUFFIXED EARLIER THAN INDICATED REFER TO PEPD-17622.

EPD-22080-O

PARTS LIST SHOWN ON
BACK OF THIS DIAGRAM

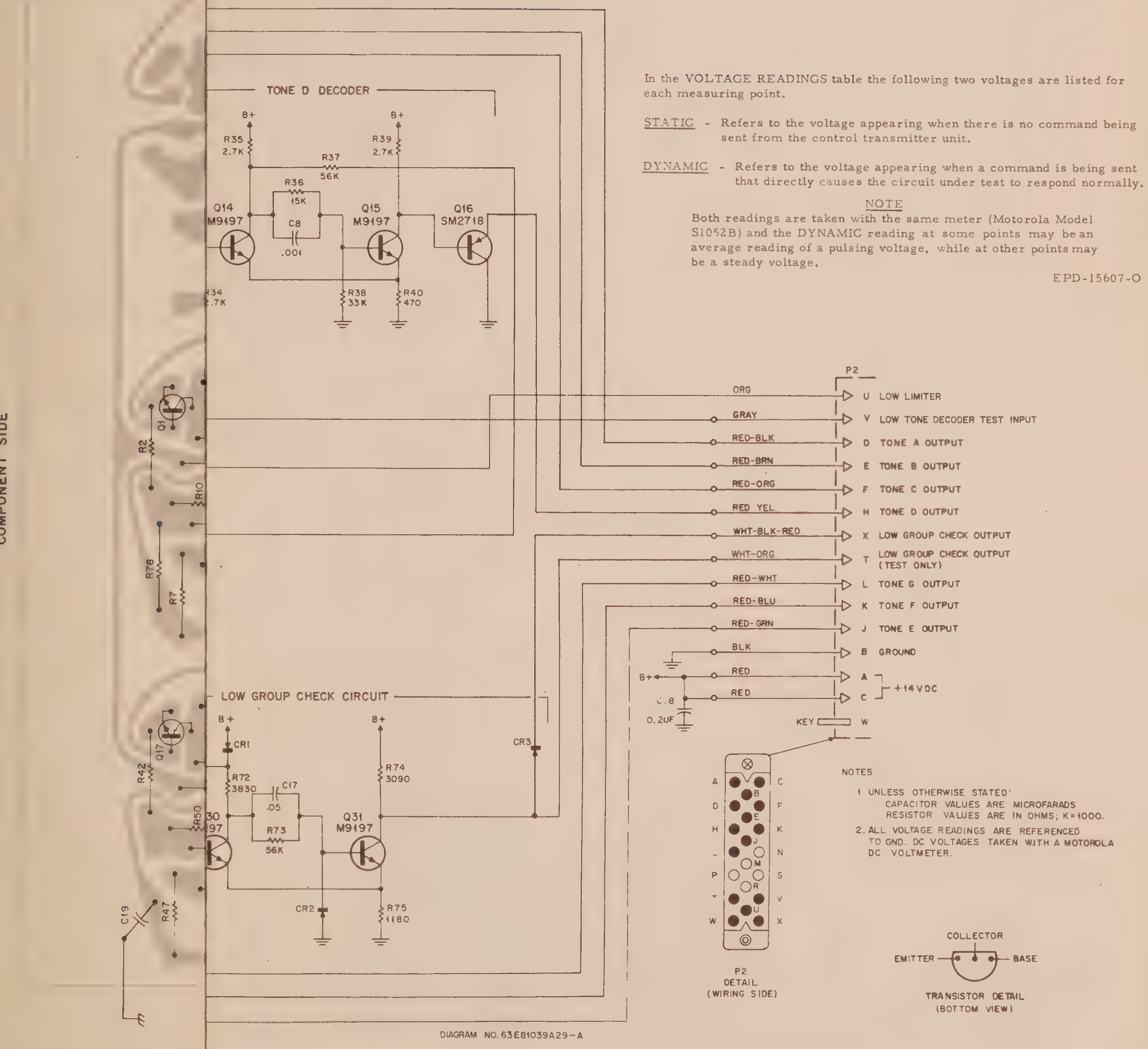
CLN6091B-1 Low Frequency Tone Decoder
Schematic Diagram and Circuit Board Detail
Motorola No. PEPD-21695-O
8/28/68-RS

VOLTAGE READINGS

TRANSISTOR	BASE	EMITTER	COLLECTOR	SIGNAL CONDITION
Q1, 5, 9, 13, 17, 21, 25	0	0	7.4	STATIC
	0	.05	6.8	DYNAMIC
Q2, 6, 10, 14, 18, 22, 26	3.3	2.6	2.7	STATIC
	3.1	2.5	3.7	DYNAMIC
Q3, 7, 11, 15, 19, 23, 27	2.0	2.6	13.6	STATIC
	2.0	2.5	12.2	DYNAMIC
Q4, 8, 12, 16, 20, 24, 28	13.6	12.6	0	STATIC
	12.2	10.8	0	DYNAMIC
Q29	2.7	3.3	0	STATIC
	3.4	4.0	0	DYNAMIC
Q30	3.3	3.8	13.1	STATIC
	4.0	3.8	13.1	DYNAMIC
Q31	4.6	3.8	4.0	STATIC
	4.6	3.8	4.0	DYNAMIC

NOTE: ALL VOLTAGE READINGS ARE REFERENCED TO GROUND.

EPD-12235-O


COMPONENT SIDE
TONE D DECODER
B+
R35 2.7K
R39 2.7K
R37 56K
R36 15K
C8 .001
Q14 M9197
Q15 M9197
Q16 SM2718
R34 2.7K
R38 33K
R40 470
Q1
R2
R10
R76
R7
Q17
R42
R50
C19
R47
LOW GROUP CHECK CIRCUIT
CR1
R72 3830
C17 .05
R73 56K
Q30 M9197
Q31 M9197
R74 3090
R75 1180
CR2
CR3
P2
ORG
GRAY
RED-BLK
RED-BRN
RED-ORG
RED YEL
WHT-BLK-RED
WHT-ORG
RED-WHT
RED-BLU
RED-GRN
BLK
RED
RED
U LOW LIMITER
V LOW TONE DECODER TEST INPUT
D TONE A OUTPUT
E TONE B OUTPUT
F TONE C OUTPUT
H TONE D OUTPUT
X LOW GROUP CHECK OUTPUT
T LOW GROUP CHECK OUTPUT (TEST ONLY)
L TONE G OUTPUT
K TONE F OUTPUT
J TONE E OUTPUT
B GROUND
A
C
+14VDC
KEY
W
C.8 0.2UF
A B C D E F H J K L M N P R S T U V W X
P2 DETAIL (WIRING SIDE)
COLLECTOR
EMITTER
BASE
TRANSISTOR DETAIL (BOTTOM VIEW)

In the VOLTAGE READINGS table the following two voltages are listed for each measuring point.

STATIC - Refers to the voltage appearing when there is no command being sent from the control transmitter unit.

DYNAMIC - Refers to the voltage appearing when a command is being sent that directly causes the circuit under test to respond normally.

NOTE

Both readings are taken with the same meter (Motorola Model S1052B) and the DYNAMIC reading at some points may be an average reading of a pulsing voltage, while at other points may be a steady voltage.

EPD-15607-O

NOTES

1. UNLESS OTHERWISE STATED:
   CAPACITOR VALUES ARE MICROFARADS
   RESISTOR VALUES ARE IN OHMS; K=1000.
2. ALL VOLTAGE READINGS ARE REFERENCED TO GND. DC VOLTAGES TAKEN WITH A MOTOROLA DC VOLTMETER.

DIAGRAM NO. 63E81039A29-A

PREVIOUS REVISIONS AND PARTS LIST SHOWN ON BACK OF THIS DIAGRAM

MODEL TABLE

MODEL	SUFFIX	DESCRIPTION
CLN6091B		LOW TONE DECODER CIRCUIT BOARD

CLN6091B Low Frequency Tone Decoder
Schematic Diagram and Circuit Board Detail
Motorola No. PEPD-17622-A
8/28/68-RS

PARTS LIST

CLN6091B Low Tone Decoder EPD-21786-O

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
		CAPACITOR, fixed: uf, unl stated
C1, 3, 5, 7, 9	23D82783B16	2.2 ±20%; 20 v
C2, 4, 6, 8, 10, 12, 14	21C82187B20	.001 ±10%; 100 v
C11, 13	23D82783B15	1.5 ±10%; 15 v
C15	8D82905G08	.033 ±10%; 50 v
C16	8D83293B18	.15 ±10%; 50 v
C18	21C82372C05	0.2 +80-20%; 25v
		SEMICONDUCTOR DEVICE, diode: (SEE NOTE)
CR1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14	48C82392B03	rectifier (RD1343)
		CONNECTOR, plug:
P1	1V80765A80	assy; male; 20 cont. incl. 14A83102B01 INSULATOR, conn 42A83312D01 CLIP conn. (2 req'd.) 36A83313D01 KNOB (2 req'd.) 22B82637B02 PIN, drive (2 req'd.) 3A83275D05 JACKSCREW (male) & 3A83275D06 JACKSCREW (female)
P2	1V80765A79	assy; male; 14 cont. incl. 14A83102B03 INSULATOR, conn 42A83312D01 CLIP, conn. (2 req'd.) 36A83313D01 KNOB (2 req'd.) 22B82637B02 PIN, drive (2 req'd.) 3A83275D05 JACKSCREW (male) & 3A83275D06 JACKSCREW (female)
		TRANSISTOR: (SEE NOTE)
Q1, 2, 3, 5, 6, 7, 9, 10, 11, 13, 14, 15, 17, 18, 19, 20, 22, 23, 25, 26, 27, 29, 33	48R86952B	N-P-N; type M9528
Q4, 8, 12, 16, 20, 24, 28, 30, 31, 32, 34	48R869417	P-N-P; type M9517
		RESISTOR, fixed: ±5%, 1/4 w; unl stated
R1, 11, 21, 31, 41, 51, 61	6S129804	2.2K
R2, 12, 22, 32, 42, 52, 62	6S131524	100
R3, 13, 23, 33, 43, 53, 63	6S129681	1.5K
R4, 5, 7, 9, 14, 15, 17, 19, 24, 25, 27, 29, 34, 35, 37, 39, 44, 45, 47, 49, 54, 55, 57, 59, 64, 65, 67, 69	6S129707	2.7K
R6, 16, 26, 36, 46, 56, 66	6S129236	15K
R8, 18, 28, 38, 48, 58, 68, 71, 74, 75, 77, 81, 82, 83	6S129526	33K
R10, 20, 30, 40, 50, 60, 70	6S129709	470
R72, 78	6S82672B19	1180
R73	6S129819	3.9K
R79	6D82672B27	1960
R80	6D82672B17	2670

NOTE:

Replacement diodes and transistors must be ordered by Motorola part number only for optimum performance.

FOR MODELS SUFFIXED 1
OR LATER REFER TO
PEPD-21695

EPD-22081-O

VOLTAGE READINGS

TRANSISTOR	BASE	EMITTER	COLLECTOR	SIGNAL CONDITION
[illegible]			1	STATIC
				DYNAMIC
[illegible]		2		STATIC
		2		DYNAMIC
[illegible]	2	2		STATIC
	2	2		DYNAMIC
[illegible]	3	2		STATIC
	2	0		DYNAMIC
[illegible]	2			STATIC
	3			DYNAMIC
[illegible]	3			STATIC
	4			DYNAMIC
[illegible]	4			STATIC
	4			DYNAMIC

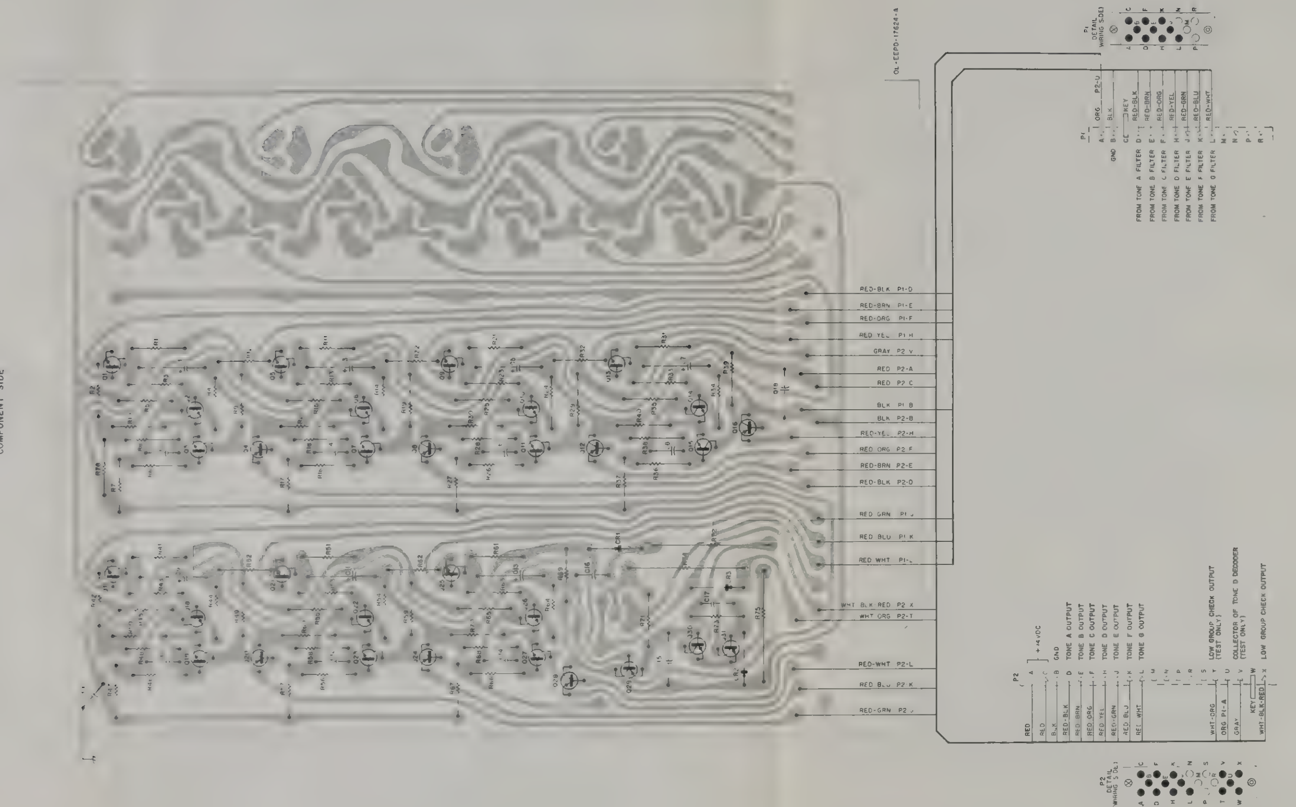
NOTE [illegible] AGE READINGS ARE [illegible] ED TO GROUND.

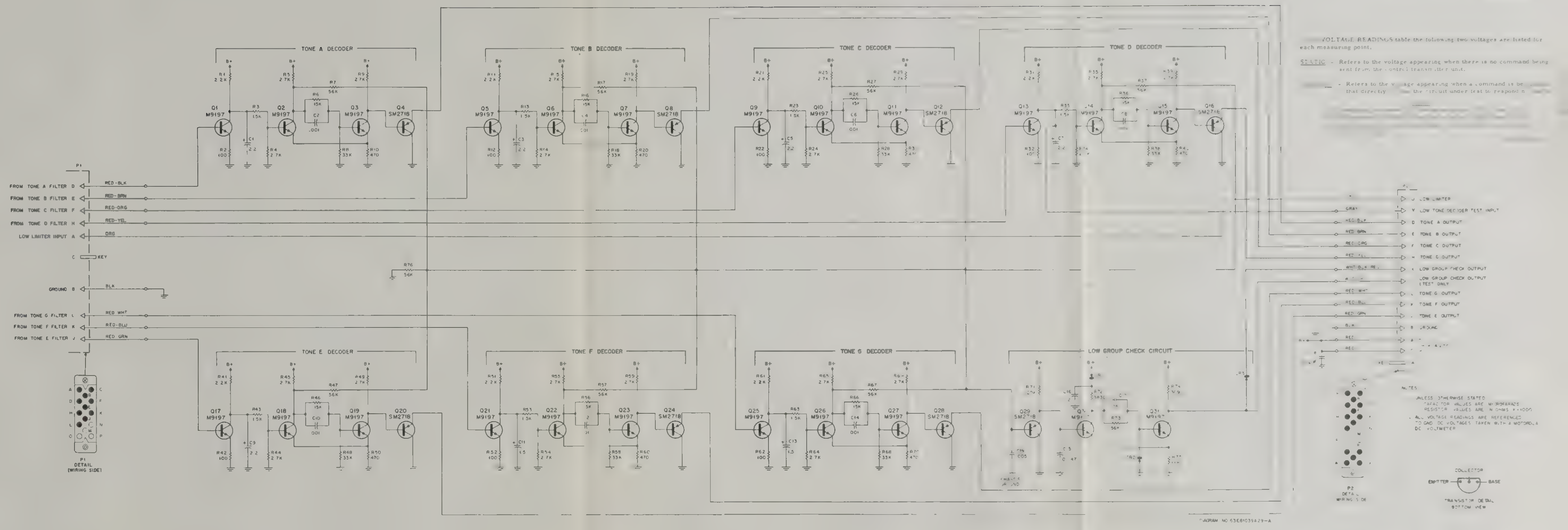
EPD-12235-O

[illegible] VOLTAGE READINGS table the following two voltages are listed for each measuring point.

STATIC - Refers to the voltage appearing when there is no command being sent from the control transmitter unit.

[illegible] - Refers to the voltage appearing when a command is be[illegible] that directly [illegible] the circuit under test to respond [illegible]


COMPONENT SIDE
RED-BLK P1-D
RED-BRN P1-E
RED-ORG P1-F
RED-YEL P1-H
GRAY P2-V
RED P2-A
RED P2-C
BLK P1-B
BLK P2-B
RED-YEL P2-H
RED-ORG P2-F
RED-BRN P2-E
RED-BLK P2-D
RED-GRN P1-J
RED-BLU P1-K
RED-WHT P1-L
WHT-BLK-RED P2-X
WHT-ORG P2-Y
RED-WHT P2-L
RED-BLU P2-K
RED-GRN P2-J
P1
P2
FROM TONE A FILTER
FROM TONE B FILTER
FROM TONE C FILTER
FROM TONE D FILTER
FROM TONE E FILTER
FROM TONE F FILTER
FROM TONE G FILTER
TONE A OUTPUT
TONE B OUTPUT
TONE C OUTPUT
TONE D OUTPUT
TONE E OUTPUT
TONE F OUTPUT
TONE G OUTPUT
LOW GROUP CHECK OUTPUT (TEST ONLY)
COLLECTOR OF TONE G DECODER (TEST ONLY)
LOW GROUP CHECK OUTPUT


TONE A DECODER
TONE B DECODER
TONE C DECODER
TONE D DECODER
TONE E DECODER
TONE F DECODER
TONE G DECODER
LOW GROUP CHECK CIRCUIT
FROM TONE A FILTER D
FROM TONE B FILTER E
FROM TONE C FILTER F
FROM TONE D FILTER H
LOW LIMITER INPUT A
KEY
GROUND B
FROM TONE G FILTER L
FROM TONE F FILTER K
FROM TONE E FILTER J
P1 DETAIL (WIRING SIDE)
M9197
SM2718
LOW LIMITER
LOW TONE DECODER TEST INPUT
TONE A OUTPUT
TONE B OUTPUT
TONE C OUTPUT
TONE D OUTPUT
LOW GROUP CHECK OUTPUT
LOW GROUP CHECK OUTPUT (TEST ONLY)
TONE E OUTPUT
TONE F OUTPUT
TONE G OUTPUT
GROUND
P2 DETAIL WIRING SIDE
COLLECTOR
EMITTER
BASE
TRANSISTOR DETAIL BOTTOM VIEW
3E81039A29-A

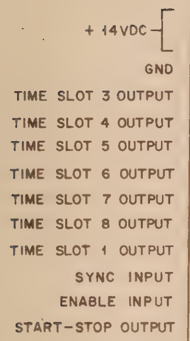
NOTES:
UNLESS OTHERWISE STATED
CAPACITOR VALUES ARE MICROFARADS
RESISTOR VALUES ARE IN OHMS K=1000
ALL VOLTAGE READINGS ARE REFERENCED TO GND. DC VOLTAGES TAKEN WITH A MOTOROLA DC VOLTMETER

PREVIOUS REVISIONS AND PARTS LIST
[illegible]WN ON BACK OF THIS DIAGRAM

MODEL TABLE

MODEL	SUFFIX	DESCRIPTION
CLN6091B		LOW TONE DECODER CIRCUIT BOARD

CLN6091B Low Frequency Tone Decoder
Schematic Diagram and Circuit Board Detail
Motorola No. PEPD-17622-A
8/28/68-RS


+ 14VDC
GND
TIME SLOT 3 OUTPUT
TIME SLOT 4 OUTPUT
TIME SLOT 5 OUTPUT
TIME SLOT 6 OUTPUT
TIME SLOT 7 OUTPUT
TIME SLOT 8 OUTPUT
TIME SLOT 1 OUTPUT
SYNC INPUT
ENABLE INPUT
START-STOP OUTPUT

OTHERWISE STATED:
ACITOR VALUES ARE MICROFARADS.
ISTOR VALUES ARE IN OHMS; K=1000.
LTAGE READINGS ARE REFERENCED TO
DC READINGS TAKEN WITH A MOTOROLA
TIMETER.
RS IN DASHED LINES ARE FACTORY SELECTED
EQUENCY, AS REQUIRED.
BRATOR OUTPUTS REQUIRED FOR GATE OPERATION.

MODEL TABLE

L	SUFFIX	DESCRIPTION
32B		SEQUENCE VERIFIER BOARD

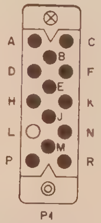
VOLTAGE READINGS

TRANSISTOR OR REFERENCE POINT	BASE	EMITTER	COLLECTOR	OTHER	SIGNAL CONDITION
Q15, 14, 13, 12, 11	1.4	11.2	12.7		STATIC
	1.8	7.2	12.7		DYNAMIC
Q10	1.4	1.4	13.5		STATIC
	1.5	1.3	11.8		DYNAMIC
Q9	2.1	1.4	1.6		STATIC
	1.5	1.3	12.1		DYNAMIC
Q8	0	0	12.6		STATIC
	0.6	0	1.5		DYNAMIC
Q7	0.7	0	0.1		STATIC
	0.1	0	11.1		DYNAMIC
Q6, Q3	0.3	0.7	12.7		STATIC
	0.8	0.7	6.7		DYNAMIC
Q5, Q4	1.4	0.7	0.9		STATIC
	0.8	0.7	6.7		DYNAMIC
Q2	1.4	0.7	0.9		STATIC
	1.1	0.7	6.7		DYNAMIC
Q1	0.6	0.7	13.1		STATIC
	1.0	0.7	6.5		DYNAMIC
JUNCTION OF CR7 & R7	-	-	-	13.1	STATIC
	-	-	-	13.0	DYNAMIC
JUNCTION OF R6 & C4	-	-	-	1.2	STATIC
	-	-	-	-0.8	DYNAMIC
JUNCTION OF R4 & C1	-	-	-	1.9	STATIC
	-	-	-	-0.9	DYNAMIC
JUNCTION OF C7 & R9	-	-	-	12.7	STATIC
	-	-	-	6.7	DYNAMIC
JUNCTION OF C9 & R14	-	-	-	0.9	STATIC
	-	-	-	6.7	DYNAMIC
JUNCTION OF R25 & C14	-	-	-	0.3	STATIC
	-	-	-	11.1	DYNAMIC

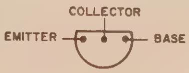
NOTE: ALL VOLTAGE READINGS ARE
REFERENCED TO GROUND

EPD-12232-O

(W


A
C
B
D
F
E
H
K
J
L
N
M
P
R

P1
DETAIL
(WIRING SIDE)


COLLECTOR
EMITTER
BASE

TRANSISTOR DETAIL
(BOTTOM VIEW)

In the VOLTAGE READINGS table the following two voltages are listed for each measuring point.

STATIC - Refers to the voltage appearing when there is no command being sent from the control transmitter unit.

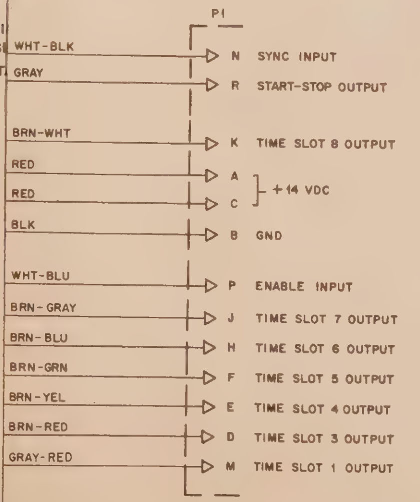
DYNAMIC - Refers to the voltage appearing when a command is being sent that directly causes the circuit under test to respond normally.

NOTE

Both readings are taken with the same meter (Motorola Model S1052B) and the DYNAMIC reading at some points may be an average reading of a pulsing voltage, while at other points may be a steady voltage.

EPD-15607-O

NOTES:
1. WHEN USED, TUNI
ARE FACTORY S
2. THIS BOARD DET
SIDE.


P1
WHT-BLK
N
SYNC INPUT
GRAY
R
START-STOP OUTPUT
BRN-WHT
K
TIME SLOT 8 OUTPUT
RED
A
RED
C
+14 VDC
BLK
B
GND
WHT-BLU
P
ENABLE INPUT
BRN-GRAY
J
TIME SLOT 7 OUTPUT
BRN-BLU
H
TIME SLOT 6 OUTPUT
BRN-GRN
F
TIME SLOT 5 OUTPUT
BRN-YEL
E
TIME SLOT 4 OUTPUT
BRN-RED
D
TIME SLOT 3 OUTPUT
GRAY-RED
M
TIME SLOT 1 OUTPUT

PREVIOUS REVISIONS AND PARTS LIST
SHOWN ON BACK OF THIS DIAGRAM

CLN6082B Sequence Verifier
Schematic Diagram and
Circuit Board Detail
Motorola No. PEPD-17625-A
8/28/68-RS

REVISIONS

DIAG. ISSUE	CHASSIS AND SUFFIX NO.	REF. SYMBOL	CHANGE	LOCATION
A	CLN6091B		EXTENSIVE CIRCUIT CHANGES REFER TO PEPD-21695	

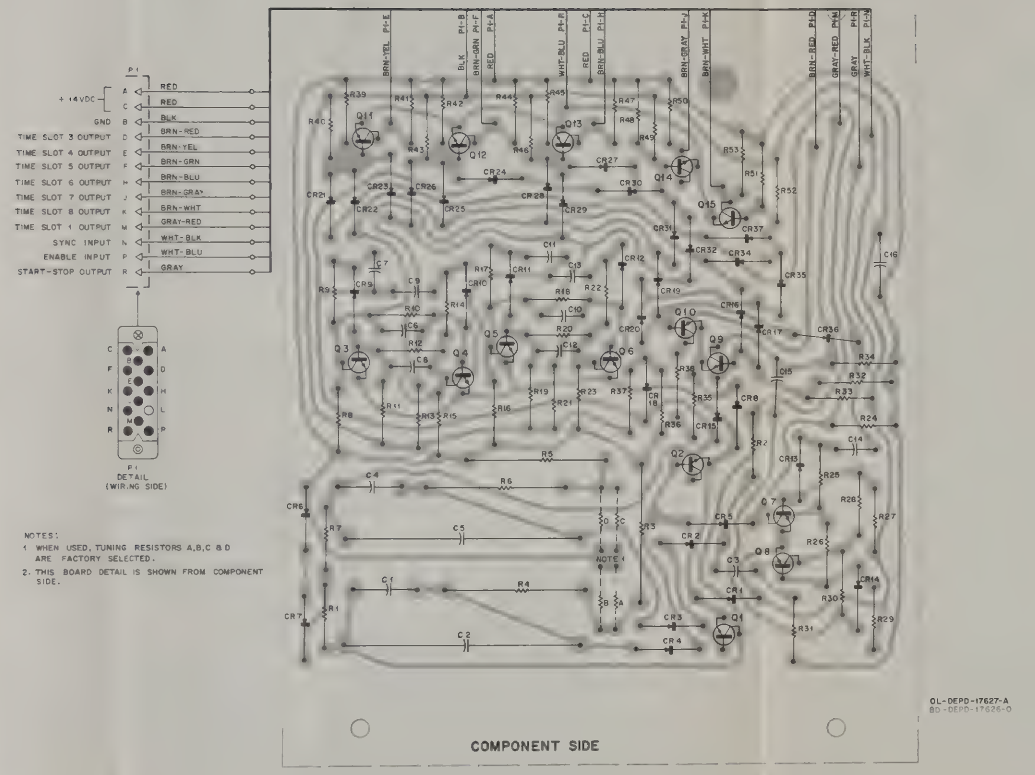
PARTS LIST

CLN6091B Low Tone Decoder EPD-13892-A

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
		CAPACITOR, fixed: uf, unl stated
C1, 3, 5, 7; 9	23D82783B16	2.2 ±20%; 20 v
C2, 4, 6, 8, 10, 12, 14	21C82187B20	.001 ±10%; 100 v
C11, 13	23D82783B15	1.5 ±10%; 15 v
C15	8D82905G03	.047 ±10%; 25 v
C16	21C82372C02	0.2 +80-20%; 25 v
C17	21C82372C04	.05 +80-20%; 25 v
C18	21C82372C05	0.2 +80-20%; 25 v
C19	21K857481	.005 ±5%; 100 v
		SEMICONDUCTOR DEVICE, diode: (SEE NOTE)
CR1, 2, 3	48C82392B03	rectifier (RD1343)
		CONNECTOR, plug:
P1	1V80765A80	assy; male; 20 cont. incl. 14A83102B01 INSULATOR, conn 42A83312D01 CLIP conn. (2 req'd.) 36A83313D01 KNOB (2 req'd.) 22B82637B02 PIN, drive (2 req'd.) 3A83275D05 JACK-SCREW (male) & 3A83275D06 JACKSCREW (female)
P2	1V80765A79	assy; male; 14 cont. incl. 14A83102B03 INSULATOR, conn 42A83312D01 CLIP, conn. (2 req'd.) 36A83313D01 KNOB (2 req'd.) 22B82637B02 PIN, drive (2 req'd.) 3A83275D05 JACK-SCREW (male) & 3A83275D06 JACKSCREW (female)
		TRANSISTOR: (SEE NOTE)
Q1, 2, 3, 5, 6, 7, 9, 10, 11, 13, 14, 15, 17, 18, 19, 20, 22, 23, 25, 26, 27, 30, 31	48R869197	N-P-N; type M9197
Q4, 8, 12, 16, 20, 24, 28, 29	48R869145	P-N-P; type SM2718
		RESISTOR, fixed: ±5%, 1/4 w; unl stated
R1, 11, 21, 31, 41, 51, 61	6S129804	2.2K
R2, 12, 22, 32, 42, 52, 62	6S131524	100
R3, 13, 23, 33, 43, 53, 63	6S129681	1.5K
R4, 5, 9, 14, 15 19, 24, 25, 29, 34, 35, 39, 44, 45, 49, 54, 55, 59, 64, 65, 69	6S129707	2.7K
R6, 16, 26, 36, 46, 56, 66	6S129236	15K
R7, 17, 27, 37, 47, 57, 67, 73	6S128684	56K
R8, 18, 28, 38, 48, 58, 68	6S129526	33K
R10, 20, 30, 40 50, 60, 70	6S129709	470
R71	6S131446	120K
R72	6D82672B37	3830 ±1%
R74	6D82672B36	3090 ±1%
R75	6D82672B19	1180 ±1%

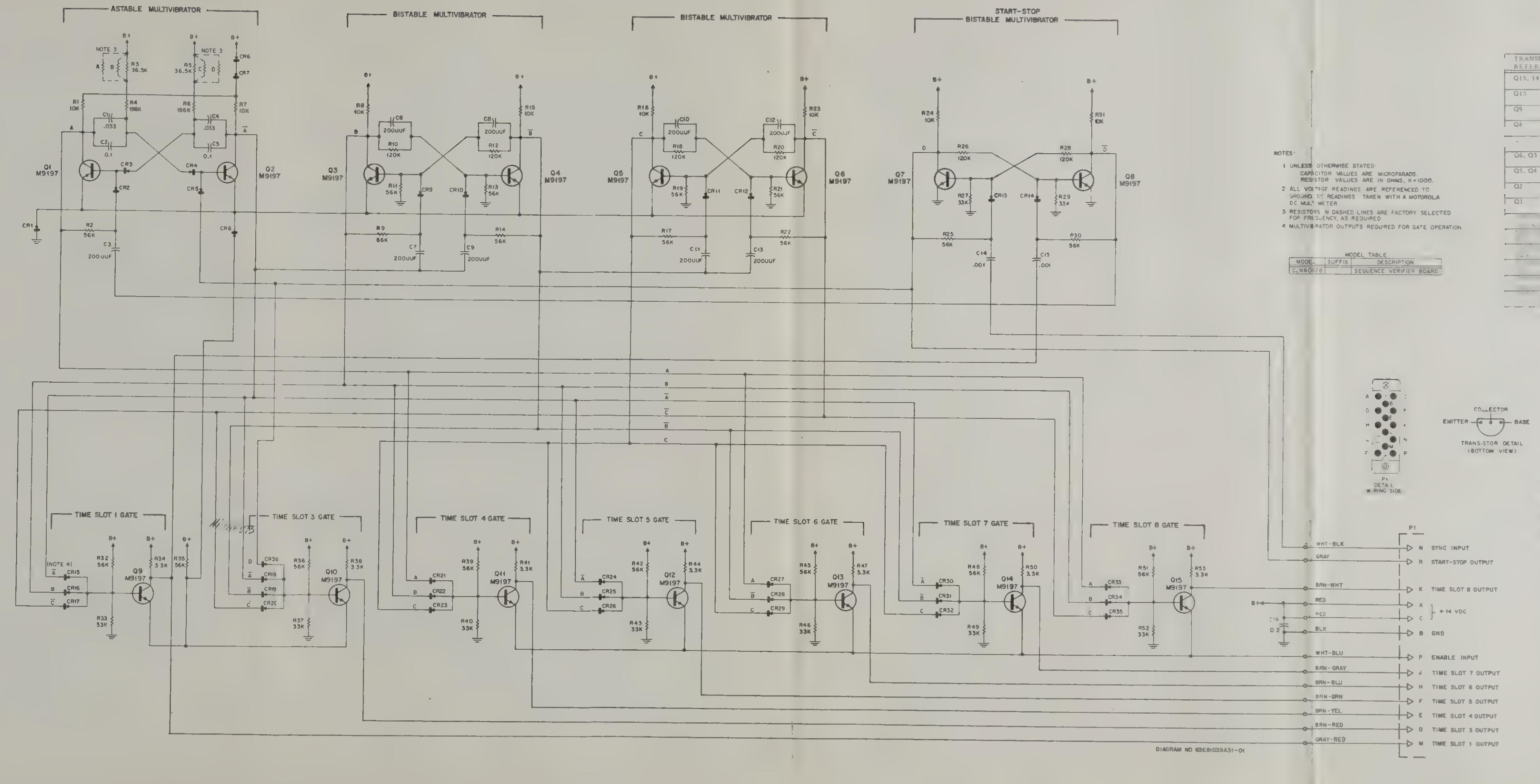
NOTE:

Replacement diodes and transistors must be ordered by Motorola part number only for optimum performance.


P1
+14VDC
A RED
C RED
GND B BLK
TIME SLOT 3 OUTPUT D BRN-RED
TIME SLOT 4 OUTPUT E BRN-YEL
TIME SLOT 5 OUTPUT F BRN-GRN
TIME SLOT 6 OUTPUT H BRN-BLU
TIME SLOT 7 OUTPUT J BRN-GRAY
TIME SLOT 8 OUTPUT K BRN-WHT
TIME SLOT 1 OUTPUT M GRAY-RED
SYNC INPUT N WHT-BLK
ENABLE INPUT P WHT-BLU
START-STOP OUTPUT R GRAY
P1
DETAIL
(WIRING SIDE)
COMPONENT SIDE

NOTES:
1. WHEN USED, TUNING RESISTORS A,B,C & D ARE FACTORY SELECTED.
2. THIS BOARD DETAIL IS SHOWN FROM COMPONENT SIDE.

OL-DEPD-17627-A
BD-DEPD-17626-O


ASTABLE MULTIVIBRATOR
BISTABLE MULTIVIBRATOR
BISTABLE MULTIVIBRATOR
START-STOP
BISTABLE MULTIVIBRATOR
Q1 M9197
Q2 M9197
Q3 M9197
Q4 M9197
Q5 M9197
Q6 M9197
Q7 M9197
Q8 M9197
TIME SLOT 1 GATE
TIME SLOT 3 GATE
TIME SLOT 4 GATE
TIME SLOT 5 GATE
TIME SLOT 6 GATE
TIME SLOT 7 GATE
TIME SLOT 8 GATE
Q9 M9197
Q10 M9197
Q11 M9197
Q12 M9197
Q13 M9197
Q14 M9197
Q15 M9197
P1
SYNC INPUT
START-STOP OUTPUT
TIME SLOT 8 OUTPUT
+14 VDC
GND
ENABLE INPUT
TIME SLOT 7 OUTPUT
TIME SLOT 6 OUTPUT
TIME SLOT 5 OUTPUT
TIME SLOT 4 OUTPUT
TIME SLOT 3 OUTPUT
TIME SLOT 1 OUTPUT
COLLECTOR
EMITTER
BASE
TRANSISTOR DETAIL
(BOTTOM VIEW)
P1
DETAIL
WIRING SIDE

NOTES:
1. UNLESS OTHERWISE STATED:
CAPACITOR VALUES ARE MICROFARADS.
RESISTOR VALUES ARE IN OHMS, K=1000.
2. ALL VOLTAGE READINGS ARE REFERENCED TO GROUND. DC READINGS TAKEN WITH A MOTOROLA DC MULTIMETER.
3. RESISTORS IN DASHED LINES ARE FACTORY SELECTED FOR FREQUENCY, AS REQUIRED.
4. MULTIVIBRATOR OUTPUTS REQUIRED FOR GATE OPERATION.

MODEL TABLE

MODEL	SUFFIX	DESCRIPTION
CLN6082B		SEQUENCE VERIFIER BOARD

DIAGRAM NO 63E81039A31-01

TRANSISTOR OR REFERENCE POINT	BASE	EMITTER	COLLECTOR	OTH
Q15, 14, 13, 12, 11	1.4	[illegible]	12.7	
	1.8	7.2	12.7	
Q10	1.4	1.4	13.5	
Q9				
Q8				
Q6, Q3	0.3	0.7	12.7	
	0.8	0.7	6.7	
Q5, Q4	1.4	0.7	0.9	
	0.8	0.7	6.7	
Q2				
Q1				

[illegible] table the following two voltages are listed for [illegible]

[illegible] voltage appearing when there is no command being [illegible] control transmitter unit

[illegible] being sent [illegible] normally.

Both readings a [illegible] S..52B) and the [illegible] be a steady voltage.

EPD-15607-O

PREVIOUS REVISIONS AND PARTS LIST
SHOWN ON BACK OF THIS DIAGRAM

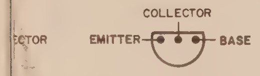
CLN6082B Sequence Verifier
Schematic Diagram and
Circuit Board Detail
Motorola No. PEPD-17625-A
8/28/68-RS

IODEL TABLE

X	DESCRIPTION
	ADDRESS VERIFIER BOARD

ERWISE SPECIFIED:
)R VALUES ARE IN MICROFARARDS.
! VALUES ARE IN OHMS; K.=1000.

;E READINGS ARE REFERENCED TO
)C READINGS TAKEN WITH A
DC MULTIMETER.



ISISTOR DETAILS
)TTOM VIEW)

VOLTAGE READINGS

TRANSISTOR OR REFERENCE POINT	BASE	EMITTER	COLLECTOR	OTHER	SIGNAL CONDITION
Q15	0.1	0	13.6		STATIC
	1.5	0.8	0.9		DYNAMIC
Q14	0.7	0	0.1		STATIC
	0.3	0	1.5		DYNAMIC
Q13	10.7	11.2	0		STATIC
	6.6	7.2	0		DYNAMIC
Q12	11.3	10.7	13.6		STATIC
	7.2	6.6	13.6		DYNAMIC
Q11	1.2	1.1	11.8		STATIC
	2.5	1.8	2.0		DYNAMIC
Q10	1.7	1.1	1.2		STATIC
	1.2	1.8	2.5		DYNAMIC
Q9	0	0	1.4		STATIC
	-0.1	0	0.8		DYNAMIC
Q8	4.9	4.3	4.4		STATIC
	5.4	4.8	5.4		DYNAMIC
Q7	4.7	4.7	13.4		STATIC
	4.7	4.7	12.5		DYNAMIC
Q6	5.3	4.7	4.7		STATIC
	5.2	4.7	4.7		DYNAMIC
Q5	0	0	13.6		STATIC
	0.1	0	11.2		DYNAMIC
Q4	0.64	0	0.2		STATIC
	0.54	0	2.3		DYNAMIC
Q3	4.7	4.7	13.4		STATIC
	4.7	4.7	12.6		DYNAMIC
Q2	5.3	4.7	4.7		STATIC
	5.2	4.7	4.7		DYNAMIC
Q1	12.6	12.1	13.6		STATIC
	9.1	8.6	13.6		DYNAMIC
JUNCTION OF R12 & C2	-	-	-	0.2	STATIC
	-	-	-	2.3	DYNAMIC
JUNCTION OF R16 & C3	-	-	-	1.1	STATIC
	-	-	-	0.2	DYNAMIC
JUNCTION OF CR8 & R19	-	-	-	13.2	STATIC
	-	-	-	11.0	DYNAMIC
JUNCTION OF CR4 & R6	-	-	-	11.7	STATIC
	-	-	-	10.7	DYNAMIC
JUNCTION OF CR9 & CR11	-	-	-	12.7	STATIC
	-	-	-	11.8	DYNAMIC
JUNCTION OF CR14 & R29	-	-	-	13.0	STATIC
	-	-	-	12.2	DYNAMIC

NOTE: ALL VOLTAGE READINGS ARE REFERENCED TO GROUND

EPD-12233-O

In the VOLTAGE READINGS table the following two voltages are listed for each measuring point.

STATIC - Refers to the voltage appearing when there is no command being sent from the control transmitter unit.

DYNAMIC - Refers to the voltage appearing when a command is being sent that directly causes the circuit under test to respond normally.

NOTE

Both readings are taken with the same meter (Motorola Model S1052B) and the DYNAMIC reading at some points may be an average reading of a pulsing voltage, while at other points may be a steady voltage.

EPD-15607-O

PREVIOUS REVISIONS AND PARTS LIST
SHOWN ON BACK OF THIS DIAGRAM

CLN6083B Address Verifier
Schematic Diagram and
Circuit Board Detail
Motorola No. PEPD-17628-C
1/8/70-RS

REVISIONS

DIAG. ISSUE	CHASSIS AND SUFFIX NO.	REF. SYMBOL	CHANGE	LOCATION
A		R3, 5	ADDED "K" TO VALUE	PARTS LIST

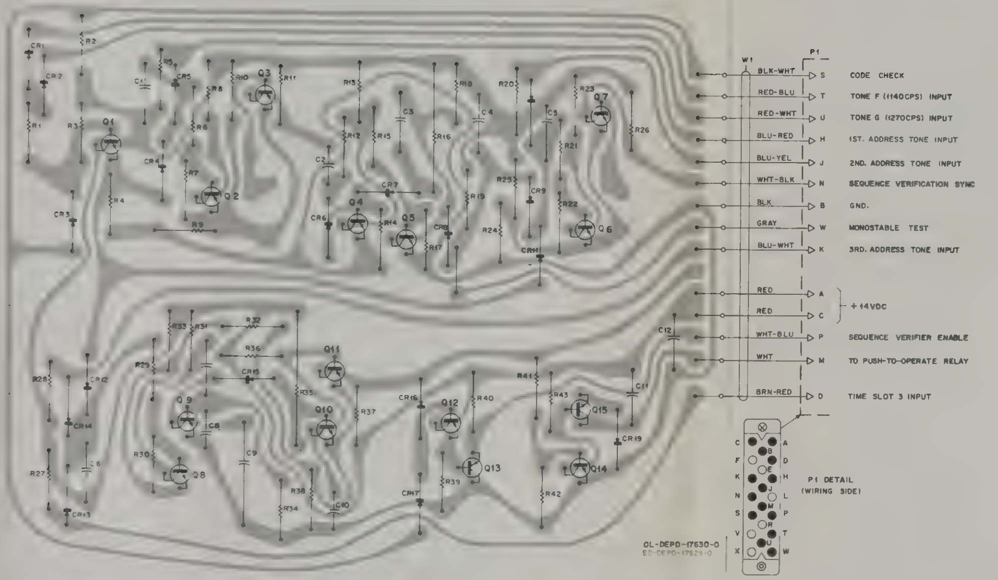
PARTS LIST

CLN6082B Sequence Verifier Board EPD-13894-B

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
		CAPACITOR, fixed:
C1, 4	8D82905G08 or 8D83293B10	.033 uf ±5%; 25 v .033 uf ±5%; 50 v
C2, 5	8D83445B21	0.1 uf ±5%; 50 v
C3, 6 thru 13	21K840812	200 uuf ±5%; 500 v
C14, 15	21D82537B16	1000 uuf ±5%; 100 v
C16	21C82372C02	0.2 uf +80-20%; 25 v
		SEMICONDUCTOR DEVICE, diode: (SEE NOTE)
CR1 thru 5, 8 thru 36	48C82392B03	silicon
CR6, 7	48K855216	germanium
		CONNECTOR, plug:
P1	1V80765A79	assy; male; 14 cont. incl. 14A83102B03 INSULATOR, conn 42A83312D01 CLIP conn. (2 req'd.) 36A83313D01 KNOB (2 req'd.) 22B82637B02 PIN, drive (2 req'd.) 3A83275D05 JACKSCREW (male) & 3A83275D06 JACKSCREW (female)
		TRANSISTOR: (SEE NOTE)
Q1 thru 15	48R869197	N-P-N; M9197
		RESISTOR, fixed: ±5%; 1/4 w; unl stated
R1, 7, 8, 15, 16, 23, 24, 31	6S129668	10K
R2, 9, 11, 13, 14, 17, 19, 21, 22, 25, 30, 32, 35, 36, 39, 42, 45, 48, 51	6S128684	56K
R3, 5	6D82672B31	36.5K ±1%
R4, 6	6D82672B30	196K ±1%
R10, 12, 18, 20, 26, 28	6S131446	120K
R27, 29, 33, 37, 40, 43, 46, 49, 52	6S129526	33K
R34, 38, 41, 44, 47, 50, 53	6S129981	3.3K

NOTE:

Replacement diodes and transistors must be ordered by Motorola part number only for optimum performance.


W1
P1
BLK-WHT S CODE CHECK
RED-BLU T TONE F (1140CPS) INPUT
RED-WHT U TONE G (1270CPS) INPUT
BLU-RED H 1ST. ADDRESS TONE INPUT
BLU-YEL J 2ND. ADDRESS TONE INPUT
WHT-BLK N SEQUENCE VERIFICATION SYNC
BLK B GND.
GRAY W MONOSTABLE TEST
BLU-WHT K 3RD. ADDRESS TONE INPUT
RED A
RED C
+14VDC
WHT-BLU P SEQUENCE VERIFIER ENABLE
WHT M TO PUSH-TO-OPERATE RELAY
BRN-RED D TIME SLOT 3 INPUT
P1 DETAIL (WIRING SIDE)
Q1 Q2 Q3 Q4 Q5 Q6 Q7 Q8 Q9 Q10 Q11 Q12 Q13 Q14 Q15
C11 C12 CR19 R23 R26 R42 R43

OL-DEPD-17630-O
BD-DEPD-17629-O

COMPONENT SIDE

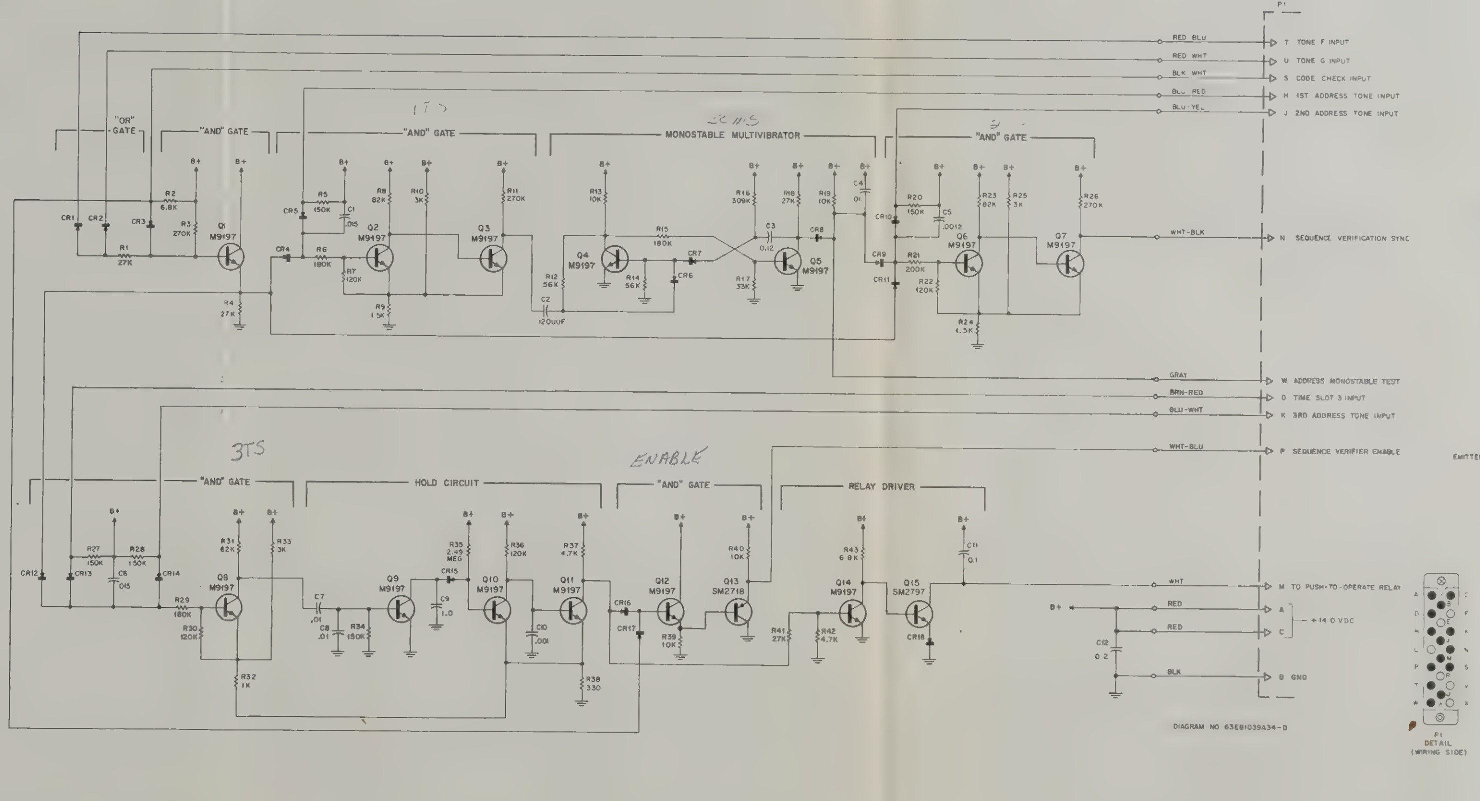

"OR" GATE
"AND" GATE
"AND" GATE
MONOSTABLE MULTIVIBRATOR
"AND" GATE
"AND" GATE
HOLD CIRCUIT
"AND" GATE
RELAY DRIVER
3TS
ENABLE
P1
RED BLU T TONE F INPUT
RED WHT U TONE G INPUT
BLK WHT S CODE CHECK INPUT
BLU RED H 1ST ADDRESS TONE INPUT
BLU-YEL J 2ND ADDRESS TONE INPUT
WHT-BLK N SEQUENCE VERIFICATION SYNC
GRAY W ADDRESS MONOSTABLE TEST
BRN-RED D TIME SLOT 3 INPUT
BLU-WHT K 3RD ADDRESS TONE INPUT
WHT-BLU P SEQUENCE VERIFIER ENABLE
WHT M TO PUSH-TO-OPERATE RELAY
RED A
RED C
+14.0 VDC
BLK B GND
B+
C12 0.2
Q7 M9197
R26 270K
P1 DETAIL (WIRING SIDE)

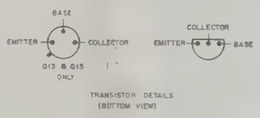
DIAGRAM NO 63E81039A34-D

MODEL TABLE

MODEL	SUFFIX	DESCRIPTION
CLN6083B	4	ADDRESS VERIFIER BOARD

NOTES:

1. UNLESS OTHERWISE SPECIFIED:
   CAPACITOR VALUES ARE IN MICROFARARDS.
   RESISTOR VALUES ARE IN OHMS; K = 1000.
2. ALL VOLTAGE READINGS ARE REFERENCED TO GROUND. DC READINGS TAKEN WITH A MOTOROLA DC MULTIMETER.


BASE
EMITTER
COLLECTOR
Q13 & Q15 ONLY
COLLECTOR
EMITTER
BASE

TRANSISTOR DETAILS (BOTTOM VIEW)

VOLTAGE READINGS

TRANSISTOR OR REFERENCE POINT	BASE	EMITTER	COLLECTOR	OTHER	SIGNAL CONDITION
[illegible]	[illegible]		[illegible]		STATIC
		[illegible]	[illegible]		[illegible]
[illegible]			[illegible]		[illegible]
			[illegible]		[illegible]
[illegible]	[illegible]	[illegible]	[illegible]		[illegible]
	[illegible]	[illegible]	[illegible]		DYNAMIC
[illegible]	[illegible]	[illegible]	[illegible]		[illegible]
	[illegible]	[illegible]	[illegible]		[illegible]
[illegible]	[illegible]	[illegible]	[illegible]		[illegible]
	[illegible]	[illegible]			[illegible]
[illegible]	[illegible]	[illegible]	[illegible]		[illegible]
	[illegible]	[illegible]	[illegible]		[illegible]
[illegible]			[illegible]		[illegible]
	[illegible]		[illegible]		DYNAMIC
[illegible]	[illegible]	[illegible]	[illegible]		[illegible]
	[illegible]	[illegible]	[illegible]		[illegible]
[illegible]	[illegible]	[illegible]	[illegible]		[illegible]
	[illegible]	[illegible]	[illegible]		[illegible]
[illegible]		[illegible]	[illegible]		[illegible]
	[illegible]	[illegible]	[illegible]		[illegible]
[illegible]			[illegible]		[illegible]
			[illegible]		[illegible]
[illegible]	[illegible]		[illegible]		[illegible]
	[illegible]		[illegible]		[illegible]
[illegible]	[illegible]	[illegible]	[illegible]		[illegible]
	[illegible]	[illegible]	[illegible]		[illegible]
[illegible]		[illegible]	[illegible]		[illegible]
		[illegible]	[illegible]		[illegible]
Q1		[illegible]	[illegible]		[illegible]
	[illegible]	[illegible]	[illegible]		[illegible]
JUNCTION OF R12 & C2	[illegible]			[illegible]	[illegible]
		[illegible]	[illegible]		[illegible]
JUNCTION OF [illegible]				[illegible]	[illegible]
					[illegible]
JUNCTION OF CR8 & R19			[illegible]		[illegible]
			[illegible]	[illegible]	DYNAMIC
JUNCTION OF CR4 & R6				[illegible]	[illegible]
	-	-	-	10.7	DYNAMIC
JUNCTION OF CR9 & CR11	-	-	-	12.7	STATIC
	-	-	-	11.8	DYNAMIC
JUNCTION OF CR14 & R29	-	-	-	13.0	STATIC
		[illegible]		[illegible]	DYNAMIC

NOTE: ALL VOLTAGE READINGS ARE REFERENCED TO GROUND

EPD-12233-O

In the VOLTAGE READINGS table the following two voltages are listed for each measuring point.

STATIC - Refers to the voltage appearing when there is no command being sent from the control transmitter unit.

DYNAMIC - Refers to the voltage appearing when a command is being sent that directly causes the circuit under test to respond normally.

NOTE

Both readings are taken with the same meter (Motorola Model S1052B) and the DYNAMIC reading at some points may be an average reading of a pulsing voltage, while at other points may be a steady voltage.

EPD-15607-O

PREVIOUS REVISIONS AND PARTS LIST
SHOWN ON BACK OF THIS DIAGRAM

CLN6083B Address Verifier
Schematic Diagram and
Circuit Board Detail
Motorola No. PEPD-17628-C
1/8/70-RS

EVISIONS

EF. BOL	CHANGE	LOCATION
	1V80765A80 ADDED	PARTS LIST
9, 19, 29, 39, 49	WERE 8D82905G35	PARTS LIST
8 18 28, 38, 48	WERE 21D82428B58	PARTS LIST

PARTS LIST

CLN6094B Motor Function Decoder Circuit Board EPD-13898-C

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
		CAPACITOR, fixed:
C1, 6, 11, 16, 21, 26, 31, 36, 41, 46	8D82905G10 or 8D83293B09	.015 uf ±10%; 25 v .015 uf ±10%; 50 v
C2, 7, 12, 17, 22, 27, 32, 37, 42, 47	8D82905G01 or 8D83293B06	.01 uf ±10%; 25 v .01 uf ±10%; 50 v
C3, 8, 13, 18, 23, 28, 33, 38, 43, 48	21D82428B58	.01 uf +80-20%; 500 v
C4, 9, 14, 19, 24, 29, 34, 39, 44, 49	8D83293B07	0.5 uf ±10%; 50 v
C5, 10, 15, 20, 25, 30, 35, 40, 45, 50	21D82187B20	.001 uf ±10%; 100 v
C51	21C82372C02	0.2 uf +80-20%; 25 v
		SEMICONDUCTOR DEVICE, diode: (NOTE)
CR1 thru 40	48C82392B03	silicon
		CONNECTOR, plug:
P1	1V80765A80	assy; male; 20 cont. incl. 14A83102B01 INSULATOR, conn. 42A83312D01 CLIP conn. (2 req'd.) 36A83313D01 KNOB (2 req'd.) 22B82637B02 PIN, drive (2 req'd.) 3A83275D05 JACKSCREW (male) & 3A83275D06 JACKSCREW (female)
P2	1V80748A48	male; 12 cont; incl. connecting leads
		TRANSISTOR: (NOTE)
Q1 thru 40	48R869197	N-P-N; M9197
		RESISTOR, fixed: ±5%; 1/4 w; unl stated
R1, 7, 12, 18, 23, 29, 34, 40, 45, 51, 58, 64, 69, 75, 80, 86, 91, 97, 102, 108, 113	6S128683	150K
R2, 13, 24, 35, 46, 59, 70, 81, 92, 103	6S124804	180K
R3, 9, 14, 20, 25, 31, 36, 42, 47, 53, 60, 66, 71, 77, 82, 88, 93, 99, 104, 110	6S131446	120K
R4, 15, 26, 37, 48, 61, 72, 83, 94, 105	6S124A95	82K
R5, 16, 27, 38, 49, 62, 73, 84, 95, 106	6S124A60	3K
R6, 17, 28, 39, 50, 63, 74, 85, 96, 107	6S129805	1K
R8, 19, 30, 41, 52, 65, 76, 87, 98, 109	6D82475B62	2.49 meg ±1%; 1/2 w
R10, 21, 32, 43, 54, 67, 78, 89, 100, 111	6S129669	4.7K
R11, 22, 33, 44, 55, 68, 79, 90, 101, 112	6S129806	330
R56, 57	6S129236	15K

NOTE:

Replacement diodes and transistors must be ordered by Motorola part number only for optimum performance.

REVISIONS

DIAG. ISSUE	CHASSIS AND SUFFIX NO.	REF. SYMBOL	CHANGE	LOCATION
A	CLN6083B-2	C8	WAS 21D82428B11	PARTS LIST
B	CLN6083B-3	C9	WAS 8D82905G35 OR 8D83293B07 (0.5 uf)	Q9-COLL.
C	CLN6083B-4	C5	WAS 21K863291 .0015 uf	Q6 BASE
		R21	WAS 6S124B04, 180K	

PARTS LIST

CLN6083B Address Verifier Board EPD-13896-C

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
		CAPACITOR, fixed: uf; ±10%; 25 v; unl stated
C1, 6	8D82905G10	.015
	or 8D83293B09	.015; 50 v
C2	21K840713	120 uuf ±5%; 100 v
C3	8D82905G09	0.12
	or 8D83293B16	0.12; 50 v
C4, 7	8D82905G01	.01
	or 8D83293B06	.01; 50 v
C5	21K874352	.0012 ±5%; 300 v
C8	21D82428B58	.01 +80-20%; 500 v
C9	8D82045F01	1; 100 v
C10	21D82187B20	.001; 100 v
C11	8D82905G07	0.1
	or 8D83293B11	0.1; 50 v
C12	21C82372C02	0.2 +80-20%
		SEMICONDUCTOR DEVICE, diode: (SEE NOTE)
CR1 thru 18	48C82392B03	silicon
		CONNECTOR, plug:
P1	1V80765A80	assy; male; 20 cont. incl. 14A83102B01 INSULATOR, conn. 42A83312D01 CLIP, conn. (2 req'd.) 36A83313D01 KNOB (2 req'd.) 22B82637B02 PIN, drive (2 req'd.) 3A83275D05 JACKSCREW (male) & 3A83275D06 JACKSCREW (female)
		TRANSISTOR: (SEE NOTE)
Q1 thru 12, 14	48R869197	N-P-N; M9197
Q13	48R869145	P-N-P; SM2718
Q15	48R869242	N-P-N; SM2797
		RESISTOR, fixed: ±5%; 1/4 w; unl stated
R1, 4, 18, 41	6S129886	27K
R2, 43	6S129237	6.8K
R3, 11, 26	6S131858	270K
R5, 20, 27, 28, 34	6S128683	150K
R6, 15, 29	6S124B04	180K
R7, 22, 30, 36	6S131446	120K
R8, 23, 31	6S124A95	82K
R9, 24	6S129681	1.5K
R10, 25, 33	6S124A60	3K
R12, 14	6S128684	56K
R13, 19, 39, 40	6S129668	10K
R16	6D82672B33	309K ±1%
R17	6S129526	33K
R21	6S124B05	200K
R32	6S129805	1K
R35	6D82475B62	2.49 meg ±1%; 1/2 w
R37, 42	6S129669	4.7K
R38	6S129806	330

NOTE:

Replacement diodes and transistors must be ordered by Motorola part number only for optimum performance.

REVISIONS

DIAG. ISSUE	CHASSIS AND SUFFIX NO.	REF. SYMBOL	CHANGE	LOCATION
A		P1	1V80765A80 ADDED	PARTS LIST
A1	CLN6094B	C4, 9, 14, 19, 24, 29, 34, 39, 44, 49	WERE 8D82905G35	PARTS LIST
A2	CLN6094B	C3, 8 13, 18 23, 28, 33, 38, 43, 48	WERE 21D82428B58	PARTS LIST

PARTS LIST

CLN6094B Motor Function Decoder Circuit Board EPD-13898-C

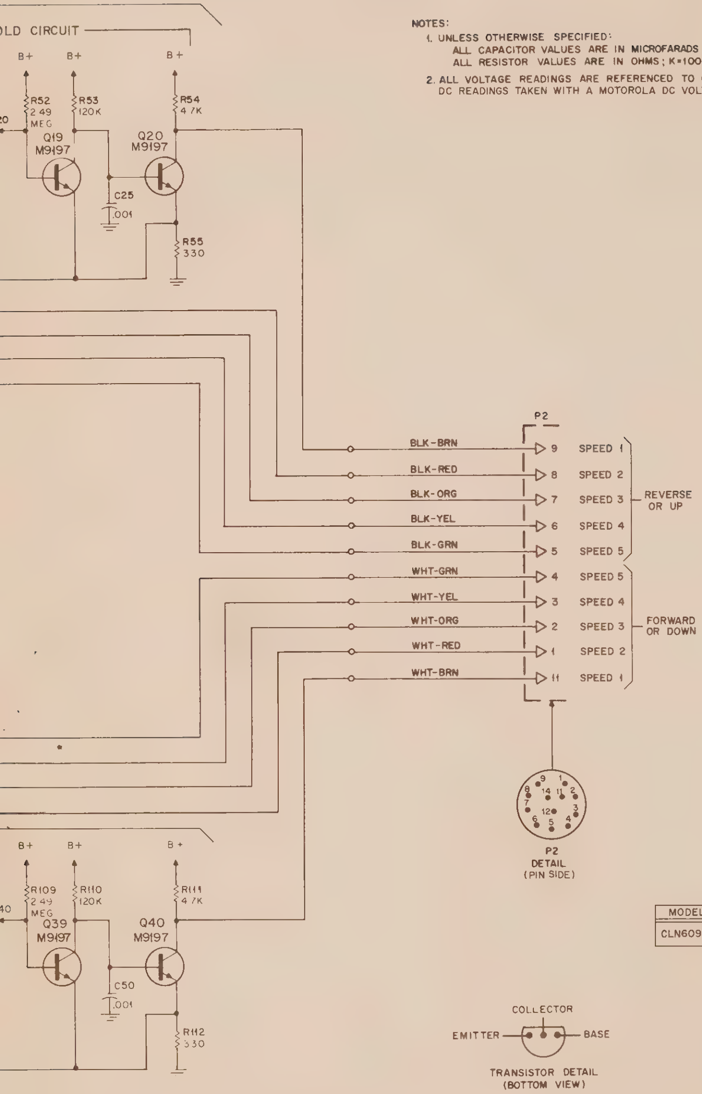
REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
		CAPACITOR, fixed:
C1, 6, 11, 16, 21, 26, 31, 36, 41, 46	8D82905G10 or 8D83293B09	.015 uf ±10%; 25 v .015 uf ±10%; 50 v
C2, 7, 12, 17, 22, 27, 32, 37, 42, 47	8D82905G01 or 8D83293B06	.01 uf ±10%; 25 v .01 uf ±10%; 50 v
C3, 8, 13, 18, 23, 28, 33, 38, 43, 48	21D82428B58	.01 uf +80-20%; 500 v
C4, 9, 14, 19, 24, 29, 34, 39, 44, 49	8D83293B07	0.5 uf ±10%; 50 v
C5, 10, 15, 20, 25, 30, 35, 40, 45, 50	21D82187B20	.001 uf ±10%; 100 v
C51	21C82372C02	0.2 uf +80-20%; 25 v
		SEMICONDUCTOR DEVICE, diode: (NOTE)
CR1 thru 40	48C82392B03	silicon
		CONNECTOR, plug:
P1	1V80765A80	assy; male; 20 cont. incl. 14A83102B01 INSULATOR, conn. 42A83312D01.CLIP conn. (2 req'd.) 36A83313D01 KNOB (2 req'd.) 22B82637B02 PIN, drive (2 req'd.) 3A83275D05 JACK-SCREW (male) & 3A83275D06 JACKSCREW (female)
P2	1V80748A48	male; 12 cont; incl. connecting leads
		TRANSISTOR: (NOTE)
Q1 thru 40	48R869197	N-P-N; M9197
		RESISTOR, fixed: ±5%; 1/4 w; unl stated
R1, 7, 12, 18, 23, 29, 34, 40, 45, 51, 58, 64, 69, 75, 80, 86, 91, 97, 102, 108, 113	6S128683	150K
R2, 13, 24, 35, 46, 59, 70, 81, 92, 103	6S124804	180K
R3, 9, 14, 20, 25, 31, 36, 42, 47, 53, 60, 66, 71, 77, 82, 88, 93, 99, 104, 110	6S131446	120K
R4, 15, 26, 37, 48, 61, 72, 83, 94, 105	6S124A95	82K
R5, 16, 27, 38, 49, 62, 73, 84, 95, 106	6S124A60	3K
R6, 17, 28, 39, 50, 63, 74, 85, 96, 107	6S129805	1K
R8, 19, 30, 41, 52, 65, 76, 87, 98, 109	6D82475B62	2.49 meg ±1%; 1/2 w
R10, 21, 32, 43, 54, 67, 78, 89, 100, 111	6S129669	4.7K
R11, 22, 33, 44, 55, 68, 79, 90, 101, 112	6S129806	330
R56, 57	6S129236	15K

NOTE:

Replacement diodes and transistors must be ordered by Motorola part number only for optimum performance.

NOTES:

1. UNLESS OTHERWISE SPECIFIED:
   ALL CAPACITOR VALUES ARE IN MICROFARADS
   ALL RESISTOR VALUES ARE IN OHMS; K=1000
2. ALL VOLTAGE READINGS ARE REFERENCED TO GROUND. DC READINGS TAKEN WITH A MOTOROLA DC VOLTMETER.

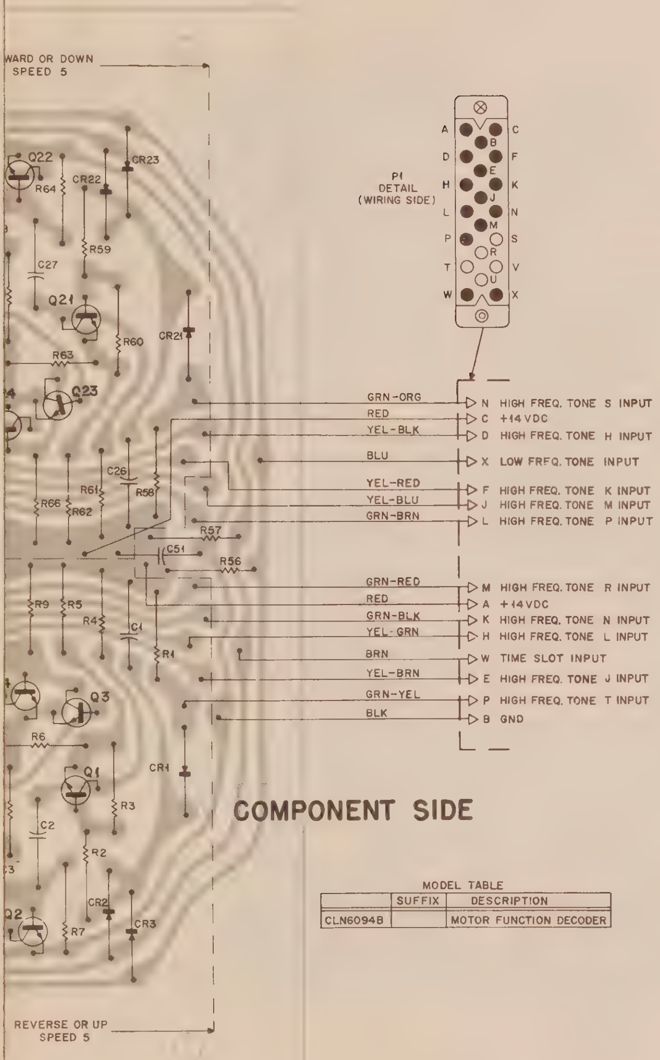


OLD CIRCUIT
B+
B+
B+
R52
2.49
MEG
R53
120K
R54
4.7K
Q19
M9197
Q20
M9197
C25
.001
R55
330
P2
BLK-BRN
BLK-RED
BLK-ORG
BLK-YEL
BLK-GRN
WHT-GRN
WHT-YEL
WHT-ORG
WHT-RED
WHT-BRN
9 SPEED 1
8 SPEED 2
7 SPEED 3
6 SPEED 4
5 SPEED 5
REVERSE OR UP
4 SPEED 5
3 SPEED 4
2 SPEED 3
1 SPEED 2
11 SPEED 1
FORWARD OR DOWN
9 1 8 14 11 2 7 12 3 6 5 4
P2
DETAIL
(PIN SIDE)
B+
B+
B+
R109
2.49
MEG
R110
120K
R111
4.7K
Q39
M9197
Q40
M9197
C50
.001
R112
330
COLLECTOR
EMITTER
BASE
TRANSISTOR DETAIL
(BOTTOM VIEW)

MODEL TABLE

MODEL	SUFFIX	DESCRIPTION
CLN6094B		MOTOR FUNCTION DECODER CIRCUIT BOARD

DIAGRAM NO. 63E81039A32—A2

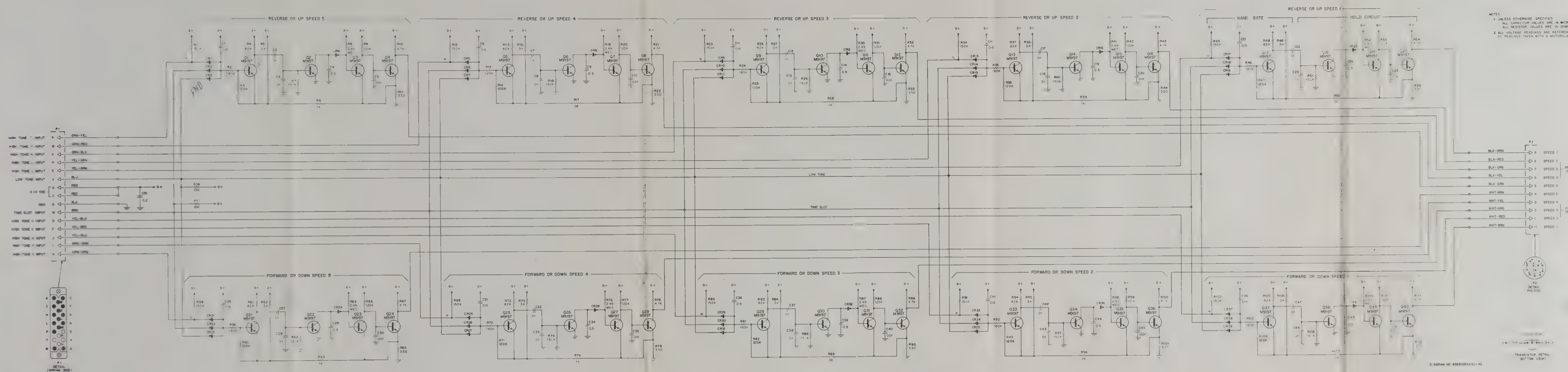


WARD OR DOWN
SPEED 5
Q22
R64
CR22
CR23
R59
C27
Q21
R60
CR21
R63
Q23
C26
R61
R58
R66
R62
R57
C51
R56
R9
R5
R4
C1
R1
Q3
R6
Q1
CR1
R3
C2
R2
CR2
CR3
Q2
R7
REVERSE OR UP
SPEED 5
P1
DETAIL
(WIRING SIDE)
A
B
C
D
E
F
H
J
K
L
M
N
P
R
S
T
U
V
W
X
GRN-ORG
N HIGH FREQ. TONE S INPUT
RED
C +14 VDC
YEL-BLK
D HIGH FREQ. TONE H INPUT
BLU
X LOW FREQ. TONE INPUT
YEL-RED
F HIGH FREQ. TONE K INPUT
YEL-BLU
J HIGH FREQ. TONE M INPUT
GRN-BRN
L HIGH FREQ. TONE P INPUT
GRN-RED
M HIGH FREQ. TONE R INPUT
RED
A +14 VDC
GRN-BLK
K HIGH FREQ. TONE N INPUT
YEL-GRN
H HIGH FREQ. TONE L INPUT
BRN
W TIME SLOT INPUT
YEL-BRN
E HIGH FREQ. TONE J INPUT
GRN-YEL
P HIGH FREQ. TONE T INPUT
BLK
B GND
COMPONENT SIDE

MODEL TABLE

	SUFFIX	DESCRIPTION
CLN6094B		MOTOR FUNCTION DECODER

CLN6094B Motor Function Decoder
Circuit Board and Wiring Diagram
Motorola No. PEPD-17631-O
8/28/68-RS


REVERSE OR UP SPEED 5
REVERSE OR UP SPEED 4
REVERSE OR UP SPEED 3
REVERSE OR UP SPEED 2
REVERSE OR UP SPEED 1
NAND GATE
HOLD CIRCUIT
FORWARD OR DOWN SPEED 5
FORWARD OR DOWN SPEED 4
FORWARD OR DOWN SPEED 3
FORWARD OR DOWN SPEED 2
FORWARD OR DOWN SPEED 1
P1
HIGH TONE T INPUT P GRN-YEL
HIGH TONE R INPUT M GRN-RED
HIGH TONE N INPUT K GRN-BLK
HIGH TONE L INPUT H YEL-GRN
HIGH TONE J INPUT E YEL-BRN
LOW TONE INPUT X BLU
+14 VDC A RED
C RED
GND B BLK
TIME SLOT INPUT W BRN
HIGH TONE H INPUT D YEL-BLK
HIGH TONE K INPUT F YEL-RED
HIGH TONE M INPUT J YEL-BLU
HIGH TONE P INPUT L GRN-BRN
HIGH TONE S INPUT N GRN-ORG
C51 0.2
R56 15K
R57 15K
B+
LOW TONE
TIME SLOT
P1 DETAIL (WIRING SIDE)
P2
BLK-BRN 9 SPEED 1
BLK-RED 8 SPEED 2
BLK-ORG 7 SPEED 3
BLK-YEL 6 SPEED 4
BLK GRN 5 SPEED 5
REVERSE OR UP
WHT-GRN 4 SPEED 5
WHT-YEL 3 SPEED 4
WHT-ORG 2 SPEED 3
WHT-RED 1 SPEED 2
WHT-BRN 11 SPEED 1
FORWARD OR DOWN
P2 DETAIL PIN SIDE
TRANSISTOR DETAIL BOTTOM VIEW
M9197
DIAGRAM No. 63E81039A32-A2

NOTES
1 UNLESS OTHERWISE SPECIFIED
ALL CAPACITOR VALUES ARE IN MICROFARADS
ALL RESISTOR VALUES ARE IN OHMS K=1000
2 ALL VOLTAGE READINGS ARE REFERENCED TO GROUND
DC READINGS TAKEN WITH A MOTOROLA DC VOLTMETER

MODEL TABLE

MODEL	SUFFIX	DESCRIPTION
CLN6094B		MOTOR FUNCTION DECODER CIRCUIT BOARD

VOLTAGE READINGS

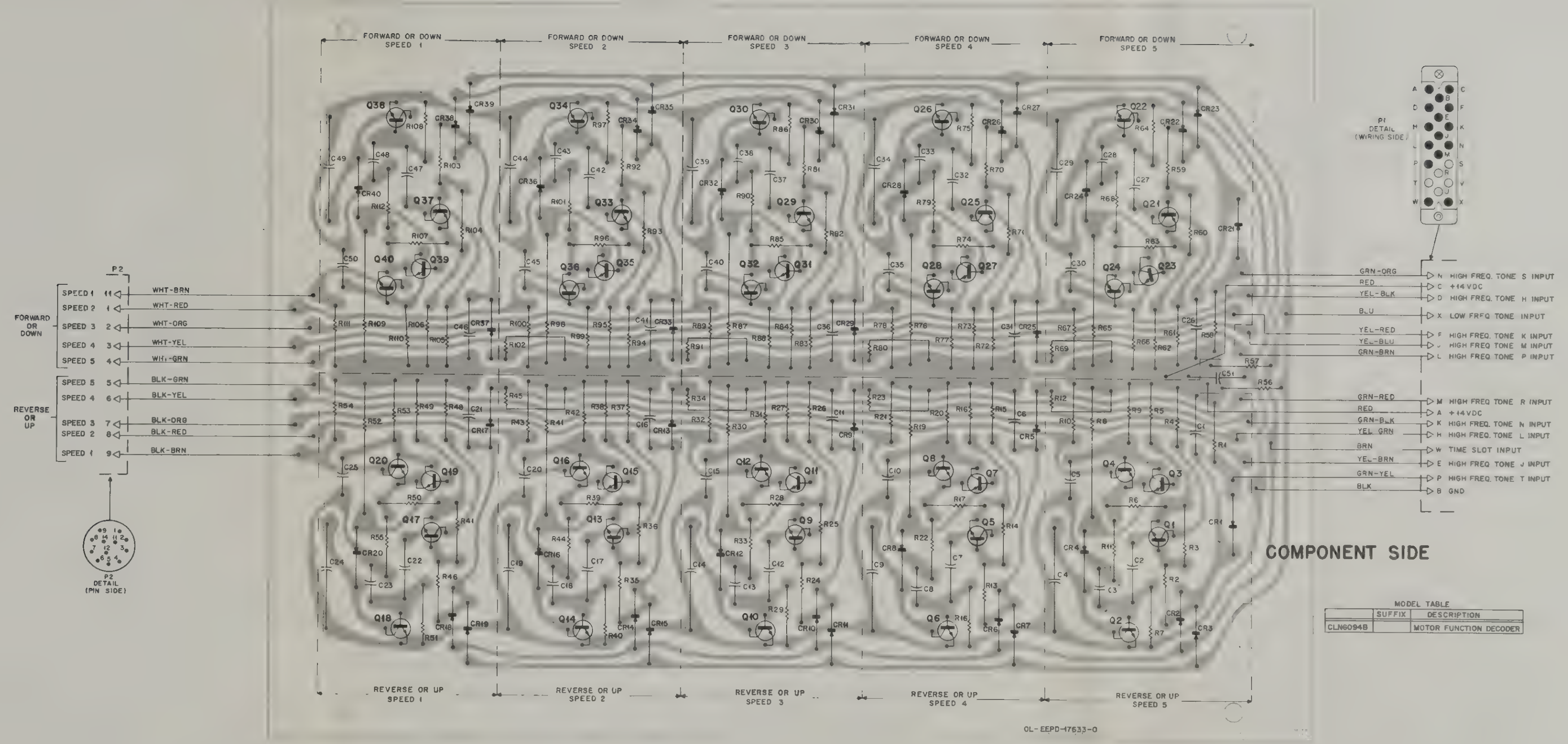
TRANSISTOR OR REFERENCE POINT	BASE	EMITTER	COLLECTOR	OTHER	SIGNAL CONDITION
Q1, 5, 9, 13, 17, 21, 25, 29, 33, 37	5.0	4.3	4.4		STATIC
	5.5	5.0	5.6		DYNAMIC
Q2, 6, 10, 14, 18, 22, 26, 28, 33, 37	0	0	1.3		STATIC
	-0.1	0	0.9		DYNAMIC
Q3, 7, 11, 15, 19, 23, 27, 30, 34, 39	1.6	1.1	1.2		STATIC
	1.3	1.9	2.6		DYNAMIC
Q4, 8, 12, 16, 20, 24, 28, 31, 35, 40	1.2	1.1	13.6		STATIC
	2.6	1.9	2.1		DYNAMIC
JUNCTION OF CR2 & R2, CR6 & R13, CR10 & R24, CR14 & R35, CR18 & R46, CR22 & R59, CR26 & R70, CR30 & R81, CR34 & R92, CR38 & R103				12.4	STATIC
				12.2	DYNAMIC

NOTE: ALL VOLTAGE READINGS ARE REFERENCED TO GROUND.

EPD-12230-O

PREVIOUS REVISIONS AND PARTS LIST
SHOWN ON FRONT OF THIS DIAGRAM

CLN6094B Motor Function Decoder Board
Schematic Diagram
Motorola No. 63E81039A32-A2
8/28/68-RS


FORWARD OR DOWN SPEED 1
FORWARD OR DOWN SPEED 2
FORWARD OR DOWN SPEED 3
FORWARD OR DOWN SPEED 4
FORWARD OR DOWN SPEED 5
P2
FORWARD OR DOWN
SPEED 1 11 WHT-BRN
SPEED 2 1 WHT-RED
SPEED 3 2 WHT-ORG
SPEED 4 3 WHT-YEL
SPEED 5 4 WHT-GRN
REVERSE OR UP
SPEED 5 5 BLK-GRN
SPEED 4 6 BLK-YEL
SPEED 3 7 BLK-ORG
SPEED 2 8 BLK-RED
SPEED 1 9 BLK-BRN
P2 DETAIL (PIN SIDE)
Q38
Q37
Q40
Q39
Q34
Q33
Q36
Q35
Q30
Q29
Q32
Q31
Q26
Q25
Q28
Q27
Q22
Q21
Q24
Q23
Q20
Q19
Q17
Q18
Q16
Q15
Q13
Q14
Q12
Q11
Q9
Q10
Q8
Q7
Q5
Q6
Q4
Q3
Q1
Q2
P1 DETAIL (WIRING SIDE)
GRN-ORG N HIGH FREQ. TONE S INPUT
RED C +14 VDC
YEL-BLK D HIGH FREQ. TONE H INPUT
BLU X LOW FREQ TONE INPUT
YEL-RED F HIGH FREQ. TONE K INPUT
YEL-BLU J HIGH FREQ TONE M INPUT
GRN-BRN L HIGH FREQ TONE P INPUT
GRN-RED M HIGH FREQ TONE R INPUT
RED A +14 VDC
GRN-BLK K HIGH FREQ. TONE N INPUT
YEL GRN H HIGH FREQ. TONE L INPUT
BRN W TIME SLOT INPUT
YEL-BRN E HIGH FREQ TONE J INPUT
GRN-YEL P HIGH FREQ. TONE T INPUT
BLK B GND
COMPONENT SIDE
REVERSE OR UP SPEED 1
REVERSE OR UP SPEED 2
REVERSE OR UP SPEED 3
REVERSE OR UP SPEED 4
REVERSE OR UP SPEED 5
OL-EEPD-17633-0

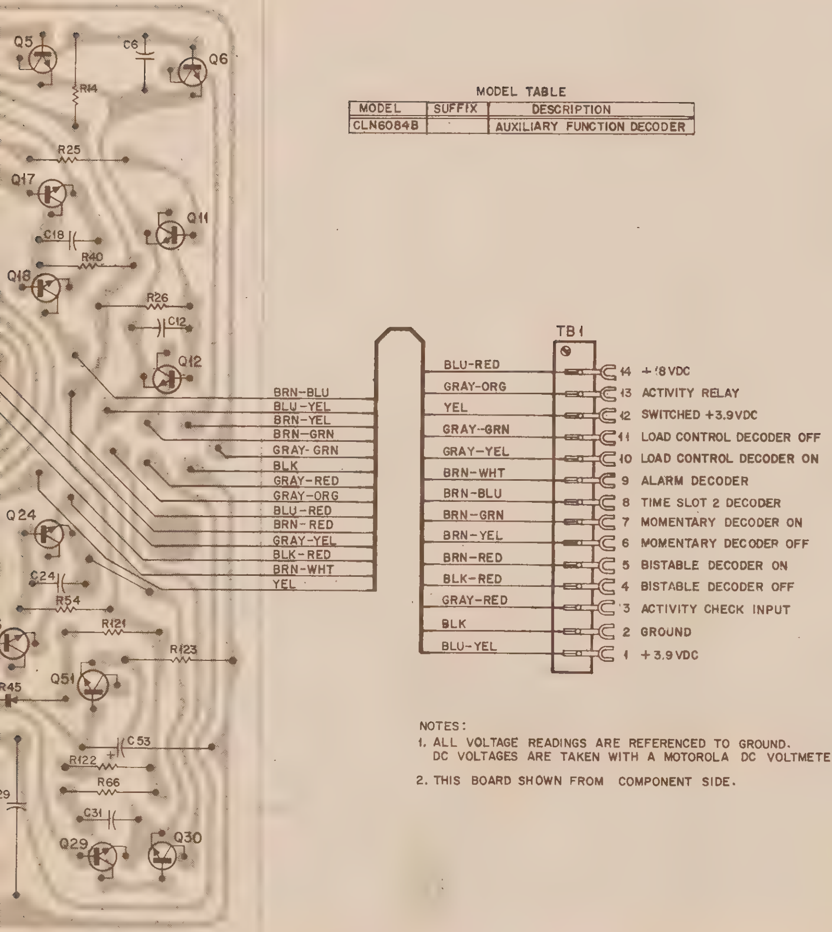
MODEL TABLE

	SUFFIX	DESCRIPTION
CLN6094B		MOTOR FUNCTION DECODER

CLN6094B Motor Function Decoder
Circuit Board and Wiring Diagram
Motorola No. PEPD-17631-O
8/28/68-RS

MODEL TABLE

MODEL	SUFFIX	DESCRIPTION
CLN6084B		AUXILIARY FUNCTION DECODER



Q5
C6
Q6
R14
R25
Q17
Q11
C18
R40
Q18
R26
C12
Q12
Q24
C24
R54
R121
R123
Q51
R45
C53
R122
R66
C31
Q29
Q30
BRN-BLU
BLU-YEL
BRN-YEL
BRN-GRN
GRAY-GRN
BLK
GRAY-RED
GRAY-ORG
BLU-RED
BRN-RED
GRAY-YEL
BLK-RED
BRN-WHT
YEL
TB1
BLU-RED
GRAY-ORG
YEL
GRAY-GRN
GRAY-YEL
BRN-WHT
BRN-BLU
BRN-GRN
BRN-YEL
BRN-RED
BLK-RED
GRAY-RED
BLK
BLU-YEL
14 +18VDC
13 ACTIVITY RELAY
12 SWITCHED +3.9VDC
11 LOAD CONTROL DECODER OFF
10 LOAD CONTROL DECODER ON
9 ALARM DECODER
8 TIME SLOT 2 DECODER
7 MOMENTARY DECODER ON
6 MOMENTARY DECODER OFF
5 BISTABLE DECODER ON
4 BISTABLE DECODER OFF
3 ACTIVITY CHECK INPUT
2 GROUND
1 +3.9VDC

NOTES:

1. ALL VOLTAGE READINGS ARE REFERENCED TO GROUND. DC VOLTAGES ARE TAKEN WITH A MOTOROLA DC VOLTMETER.
2. THIS BOARD SHOWN FROM COMPONENT SIDE.

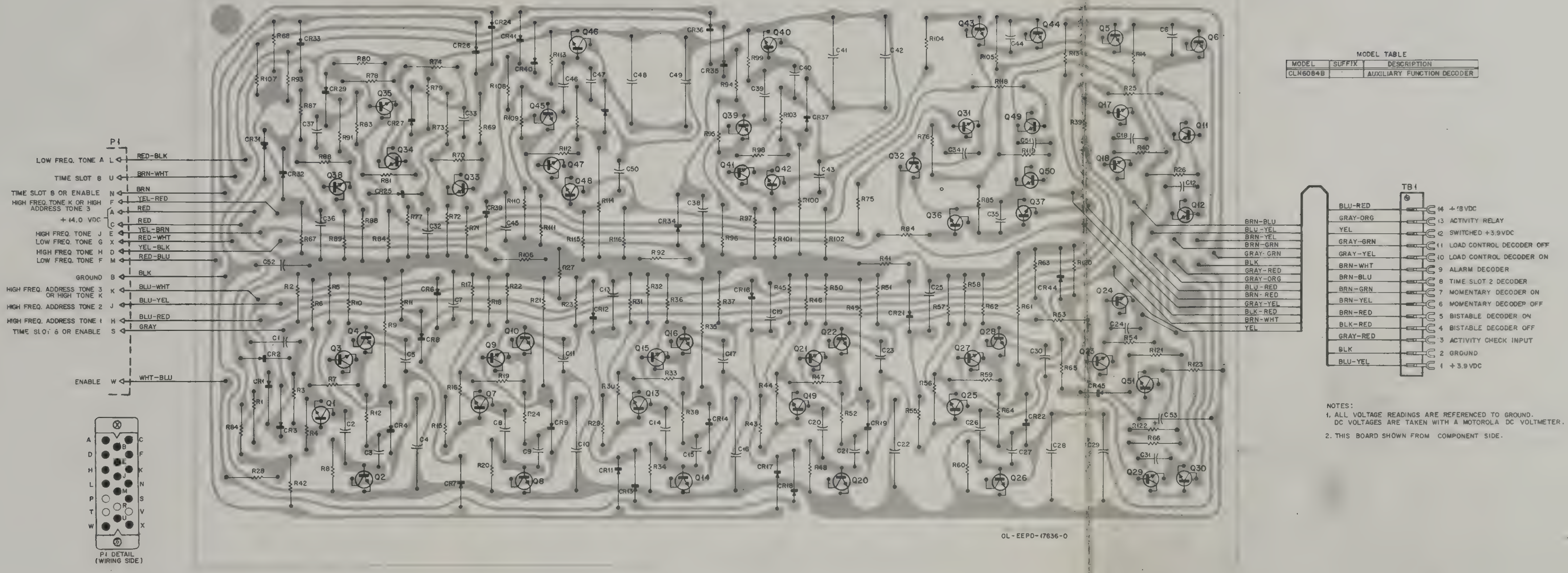
pn Decoder Board EPD-13900-D

	DESCRIPTION
	CAPACITOR, fixed: uf;
)	.015 ±10%; 25 v
09	.015 ±10%; 50 v
	.01 ±10%; 25 v
06	.01 ±10%; 50 v
8	.01 +80-20%; 500 v
5	0.5 ±10%; 25 v
07	0.5 ±10%; 50 v
20	.001 ±10%; 100 v
16	.001 ±5%; 100 v
02	0.2 +80-20%; 25 v
	15±10%; 25 v
	SEMICONDUCTOR DEVICE, diode: (NOTE)
03	silicon
	CONNECTOR, plug:
)	assy; male; 20 cont.; incl. 14A83102B01 INSULATOR, conn. 42A83312D01 CLIP, conn. (2 req'd.) 36A83313D01 KNOB (2 req'd.) 22B82637B02 PIN, drive (2 req'd.) 3A83275D05 JACKSCREW (male) & 3A83275D06 JACKSCREW (female)
	TRANSISTOR: N-P-N; (NOTE)
	M9197
	M9299
	RESISTOR, fixed: ±5%; 1/4 w unl stated
	68K
	180K
	120K
	82K
	3K
	1K
	150K
	2.49 meg ±1%; 1/2 w
	4.7K
	330
	27K
	3.9K
	1.5K
	56K
	10K

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
R120	6S129149	470K
R121	6S129777	39K
R123	6S129984	680
R124	6S129804	2.2K

NOTE:

Replacement transistors and diodes must be ordered by Motorola part number only for optimum performance.


P1
LOW FREQ. TONE A L
RED-BLK
TIME SLOT 8 U
BRN-WHT
TIME SLOT 8 OR ENABLE N
BRN
HIGH FREQ. TONE K OR HIGH ADDRESS TONE 3 F
YEL-RED
+14.0 VDC A C
RED
RED
HIGH FREQ. TONE J E
YEL-BRN
LOW FREQ. TONE G X
RED-WHT
HIGH FREQ TONE H D
YEL-BLK
LOW FREQ. TONE F M
RED-BLU
GROUND B
BLK
HIGH FREQ. ADDRESS TONE 3 OR HIGH TONE K K
BLU-WHT
HIGH FREQ. ADDRESS TONE 2 J
BLU-YEL
HIGH FREQ. ADDRESS TONE 1 H
BLU-RED
TIME SLOT 6 OR ENABLE S
GRAY
ENABLE W
WHT-BLU
P1 DETAIL (WIRING SIDE)
BRN-BLU
BLU-YEL
BRN-YEL
BRN-GRN
GRAY-GRN
BLK
GRAY-RED
GRAY-ORG
BLU-RED
BRN-RED
GRAY-YEL
BLK-RED
BRN-WHT
YEL
TB1
BLU-RED 14 +18VDC
GRAY-ORG 13 ACTIVITY RELAY
YEL 12 SWITCHED +3.9VDC
GRAY-GRN 11 LOAD CONTROL DECODER OFF
GRAY-YEL 10 LOAD CONTROL DECODER ON
BRN-WHT 9 ALARM DECODER
BRN-BLU 8 TIME SLOT 2 DECODER
BRN-GRN 7 MOMENTARY DECODER ON
BRN-YEL 6 MOMENTARY DECODER OFF
BRN-RED 5 BISTABLE DECODER ON
BLK-RED 4 BISTABLE DECODER OFF
GRAY-RED 3 ACTIVITY CHECK INPUT
BLK 2 GROUND
BLU-YEL 1 +3.9VDC
OL-EEPD-17636-O

MODEL TABLE

MODEL	SUFFIX	DESCRIPTION
CLN6084B		AUXILIARY FUNCTION DECODER

NOTES:
1. ALL VOLTAGE READINGS ARE REFERENCED TO GROUND. DC VOLTAGES ARE TAKEN WITH A MOTOROLA DC VOLTMETER.
2. THIS BOARD SHOWN FROM COMPONENT SIDE.

CLN6084B Auxiliary Function Decoder (Version I)
Circuit Board and Wiring Diagram
Motorola No. PEPD-17634-O
8/28/68-RS

REVISIONS

DIAG. ISSUE	CHASSIS AND SUFFIX NO.	REF. SYMBOL	CHANGE	LOCATION	REFER TO CIRCUIT BOARD
O1	CLN6084B		REVISED VOLTAGE READINGS TABLE		EPD-12936-A
		P1	ADDED 1V80765A80	PARTS LIST	
		R120	ADDED 470K	Q51 BASE	
		R121	ADDED 39K	Q51 COLLECTOR	
		R123	ADDED 680	Q51 EMITTER	
		R122	ADDED 4.7K		
A	CLN6084B-1	R124	ADDED 6S129804, 2.2K	Q51 BASE	AUXILIARY FUNCTION DECODER EPD-15157-A
B	CLN6084B-2	R80	WAS 6S129526, 33K	Q35 BASE	AUXILIARY FUNCTION DECODER EPD-15157-B
B1	CLN6084B-2	R79	WAS 6S129526, 33K	Q34 BASE	AUXILIARY FUNCTION DECODER EPD-15157-B1 OR PEPD-17637-O
		R80	WAS 6S124A95, 82K	Q35 BASE	
B2	CLN6084B-2	R66	WAS 33K ON SCHEMATIC DIAGRAM	Q29 COLLECTOR	NONE
C	CLN6084B-3	Q5, 6, 11, 12, 17, 18, 23, 24, 29, 30, 31, 32, 36, 37, 43, 44, 49, 50	WERE 48R869245 (TYPE M9245)	SCHEMATIC DIAGRAM	
		R13, 25, 39, 53, 65, 75, 84, 104, 118	WERE 6S129526 (33K)	SCHEMATIC DIAGRAM	
		R14, 26, 40, 54, 66, 76, 85, 105, 119	WERE 6S129981 (3.3K)	SCHEMATIC DIAGRAM	
C1	CLN6084B-3	C3, 6 9, 12, 15, 18, 21, 24, 27, 31, 34, 35, 40, 44, 47, 51	WERE 21D82428B11	PARTS LIST	

PARTS LIST

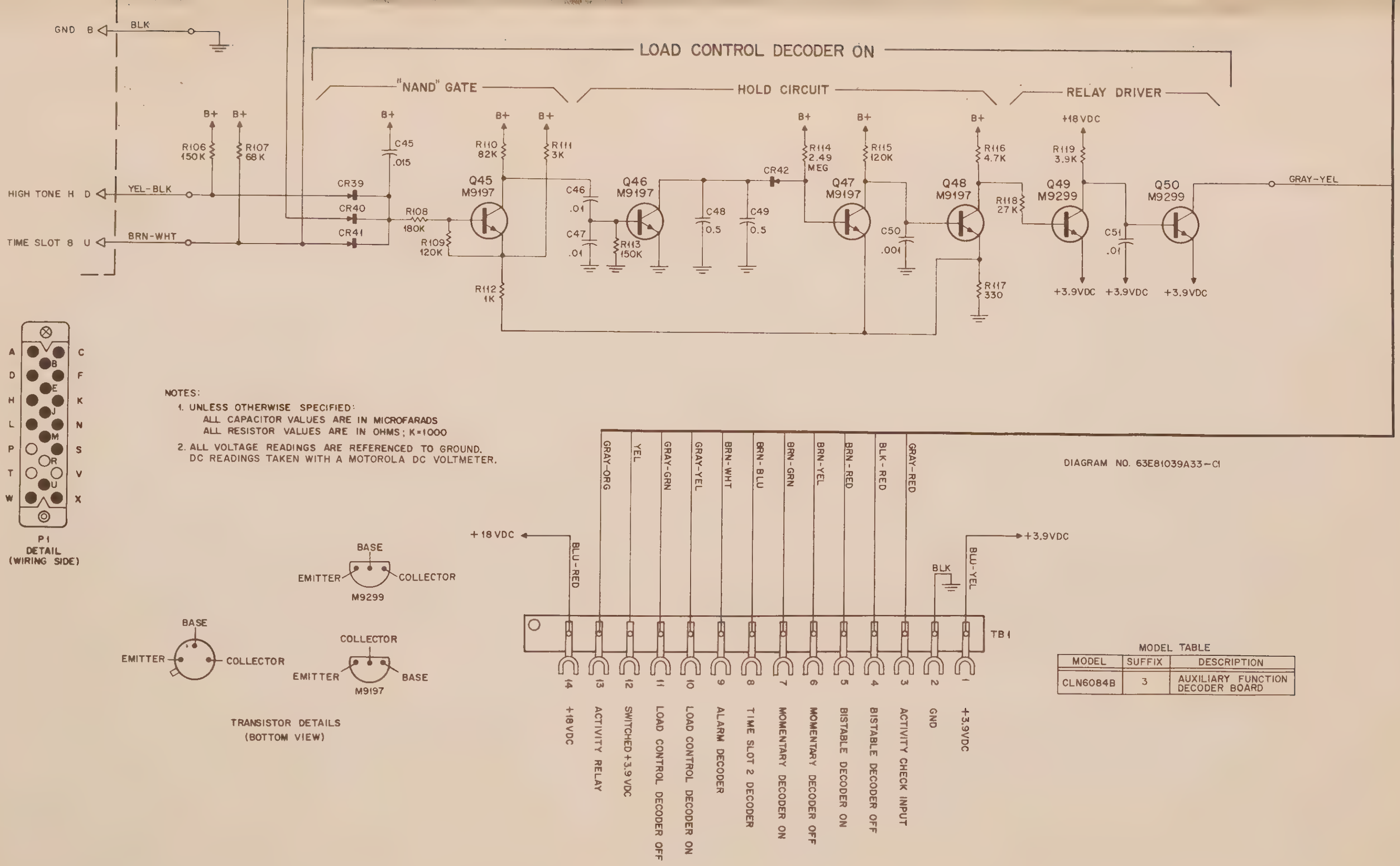
CLN6084B Auxiliary Function Decoder Board EPD-13900-D

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
		CAPACITOR, fixed: uf;
C1, 7, 13, 19, 25, 32, 36, 38, 45	8D82905G10 or 8D83293B09	.015 ±10%; 25 v .015 ±10%; 50 v
C2, 8, 14, 20, 26, 39, 46	8D82905G01 or 8D83293B06	.01 ±10%; 25 v .01 ±10%; 50 v
C3, 6, 9, 12, 15, 18, 21, 24, 27, 31, 34, 35, 40, 44, 47, 51	21D82428B58	.01 +80-20%; 500 v
C4, 10, 16, 22, 28, 29, 41, 42, 48, 49	8D82905G35 or 8D83293B07	0.5 ±10%; 25 v 0.5 ±10%; 50 v
C5, 11, 17, 23, 30, 43, 50	21C83187B20	.001 ±10%; 100 v
C33, 37	21D82537B16	.001 ±5%; 100 v
C52	21C82372C02	0.2 +80-20%; 25 v
C53	23K865136	15±10%; 25 v
		SEMICONDUCTOR DEVICE, diode: (NOTE)
CR1 thru 45	48C82392B03	silicon
		CONNECTOR, plug:
P1	1V80765A80	assy; male; 20 cont.; incl. 14A83102B01 INSULATOR, conn. 42A83312D01 CLIP, conn. (2 req'd.) 36A83313D01 KNOB (2 req'd.) 22B82637B02 PIN, drive (2 req'd.) 3A83275D05 JACKSCREW (male) & 3A83275D06 JACKSCREW (female)
		TRANSISTOR: N-P-N; (NOTE)
Q1, 2, 3, 4, 7, 8, 9, 10, 13, 14, 15, 16, 19, 20, 21, 22, 25, 26, 27, 28, 33, 34, 35, 38, 39, 40, 41, 42, 45, 46, 47, 48, 51	48R869197	M9197
Q5, 6, 11, 12, 17, 18, 23, 24, 29, 30, 31, 32, 36, 37, 43, 44, 49, 50	48R869299	M9299
		RESISTOR, fixed: ±5%; 1/4 w unl stated
R1, 2, 28, 41, 67, 68, 86, 93, 107	6S129299	68K
R3, 15, 29, 43, 55, 69, 87, 94, 108	6S124804	180K
R4, 10, 16, 22, 30, 36, 44, 50, 56, 62, 70, 78, 81, 88, 95, 101, 109, 155	6S131446	120K
R5, 17, 31, 45, 57, 71, 79, 89, 96, 110	6S124A95	82K
R6, 18, 32, 46, 58, 72, 90, 97, 111	6S124A60	3K
R7, 19, 33, 47, 59, 98, 112	6S129805	1K
R8, 20, 27, 34, 48, 60, 92, 99, 106, 113	6S128683	150K
R9, 21, 35, 49, 61, 100, 114	6D82475B62	2.49 meg ±1%; 1/2 w
R11, 23, 37, 51, 63, 102, 116, 122	6S129669	4.7K
R12, 24, 38, 52, 64, 103, 117	6S129806	330
R13, 25, 39, 42, 53, 65, 75, 80, 84, 104, 118	6S129886	27K
R14, 26, 40, 54, 66, 76, 85, 105, 119	6S129819	3.9K
R73, 91	6S129681	1.5K
R74, 83	6S128684	56K
R77, 82	6S129668	10K

REFERENCE SYMBOL	MOTOROLA PART NO	DESCRIPTION
R120	6S129149	470K
R121	6S129777	39K
R123	[illegible]	680
R124	6S129804	2.2K

NOTE:

Replacement transistors and diodes must be ordered by Motorola part number only for optimum performance.


LOAD CONTROL DECODER ON
"NAND" GATE
HOLD CIRCUIT
RELAY DRIVER
GND B
BLK
HIGH TONE H D
YEL-BLK
TIME SLOT 8 U
BRN-WHT
B+
R106 150K
R107 68K
C45 .015
CR39
CR40
CR41
R108 180K
R109 120K
Q45 M9197
R110 82K
R111 3K
R112 1K
C46 .01
C47 .01
Q46 M9197
R113 150K
C48 0.5
C49 0.5
CR42
R114 2.49 MEG
R115 120K
Q47 M9197
C50 .001
R116 4.7K
Q48 M9197
R117 330
R118 27K
+18VDC
R119 3.9K
Q49 M9299
C51 .01
Q50 M9299
+3.9VDC
GRAY-YEL
P1 DETAIL (WIRING SIDE)
A B C D E F H J K L M N P R S T U V W X
EMITTER
BASE
COLLECTOR
M9299
M9197
TRANSISTOR DETAILS (BOTTOM VIEW)
GRAY-ORG
YEL
GRAY-GRN
GRAY-YEL
BRN-WHT
BRN-BLU
BRN-GRN
BRN-YEL
BRN-RED
BLK-RED
GRAY-RED
+18 VDC
BLU-RED
BLK
BLU-YEL
+3.9VDC
TB1
14 +18VDC
13 ACTIVITY RELAY
12 SWITCHED +3.9 VDC
11 LOAD CONTROL DECODER OFF
10 LOAD CONTROL DECODER ON
9 ALARM DECODER
8 TIME SLOT 2 DECODER
7 MOMENTARY DECODER ON
6 MOMENTARY DECODER OFF
5 BISTABLE DECODER ON
4 BISTABLE DECODER OFF
3 ACTIVITY CHECK INPUT
2 GND
1 +3.9VDC

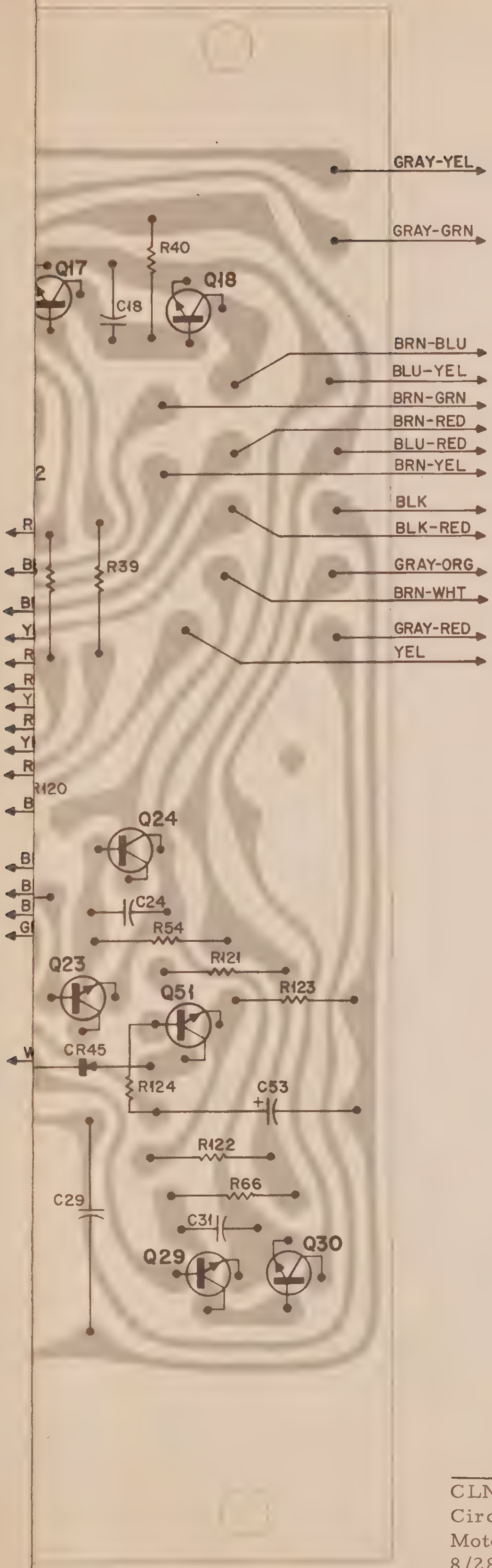
NOTES:

1. UNLESS OTHERWISE SPECIFIED:
   ALL CAPACITOR VALUES ARE IN MICROFARADS
   ALL RESISTOR VALUES ARE IN OHMS; K=1000
2. ALL VOLTAGE READINGS ARE REFERENCED TO GROUND.
   DC READINGS TAKEN WITH A MOTOROLA DC VOLTMETER.

DIAGRAM NO. 63E81039A33-C1

MODEL TABLE

MODEL	SUFFIX	DESCRIPTION
CLN6084B	3	AUXILIARY FUNCTION DECODER BOARD


GRAY-YEL
GRAY-GRN
R40
Q17
C18
Q18
BRN-BLU
BLU-YEL
BRN-GRN
BRN-RED
BLU-RED
BRN-YEL
BLK
BLK-RED
R39
GRAY-ORG
BRN-WHT
GRAY-RED
YEL
R120
Q24
C24
R54
Q23
R121
Q51
R123
CR45
R124
C53
R122
R66
C29
C31
Q29
Q30

CLN6084B-2 Auxiliary Function Decoder (Version II)
Circuit Board and Wiring Diagram
Motorola No. PEPD-17637-O
8/28/68-RS

VOLTAGE READINGS

[illegible]	[illegible]	EMITTER	COLLECTOR	OTHER	[illegible]
[illegible]		4.3	4.4		STATIC
		5.0	5.6		DYNAMIC
[illegible]		0	1.3		STATIC
		0	0.9		DYNAMIC
[illegible]	[illegible]	1.1	1.2		STATIC
		1.9	2.6		DYNAMIC
[illegible]	[illegible]	1.1	12.2		STATIC
		1.9	2.1		DYNAMIC
[illegible]	[illegible]	3.9	4.0		STATIC
	[illegible]	3.9	4.7		DYNAMIC
[illegible]	[illegible]	3.9	18.0		STATIC
	[illegible]	3.9	4.0		DYNAMIC
[illegible]		0	1.3		STATIC
		0	0.5		DYNAMIC
[illegible]	[illegible]	1.1	1.2		STATIC
	[illegible]	1.9	2.6		DYNAMIC
JUNCTION OF CR2 & R3, CR7 & R15, CR12, & R29, CR25 & R69, CR32 & R87, CR35 & R94, CR40 & R108, CR17 & R43				12.4	STATIC
				12.2	DYNAMIC
Q51	[illegible]	2.0	2.1		STATIC
		2.0	2.1		DYNAMIC
Q26		0	0.5		STATIC
		0	0.3		DYNAMIC
		0	1.3		FAULT
Q27	[illegible]	1.9	2.6		STATIC
	0.7	1.9	2.6		DYNAMIC
	1.6	1.1	1.2		FAULT
Q28	2.6	1.9	2.1		ST. & DYN.
	1.2	1.1	12.2		FAULT
Q29	2.1	3.9	4.7		ST. & DYN.
	4.6	3.9	4.0		FAULT
Q30	4.7	3.9	4.0		ST. & DYN.
	4.0	3.9	18.0		FAULT

NOTE
ALL VOLTAGE READINGS ARE REFERENCED TO GROUND.

EPD-12231-C

In the VOLTAGE READINGS table the following three voltages are listed for each measuring point.

STATIC - Refers to the voltage appearing when there is no command being sent from the control transmitter unit.

DYNAMIC Refers to the voltage appearing when a command is being sent that directly causes the circuit under test to respond normally.

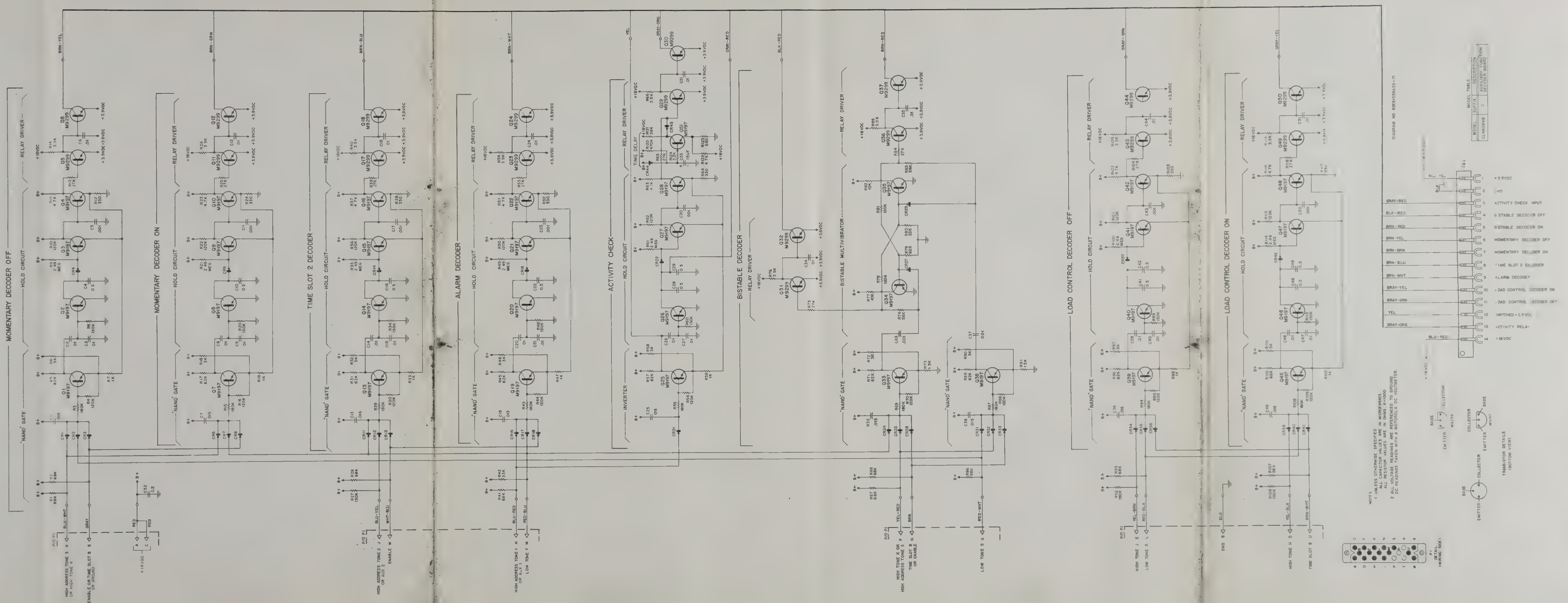
FAULT - Refers to the voltage present when there is no command being sent and when the monitored relay(s) is improperly energized or lifted.

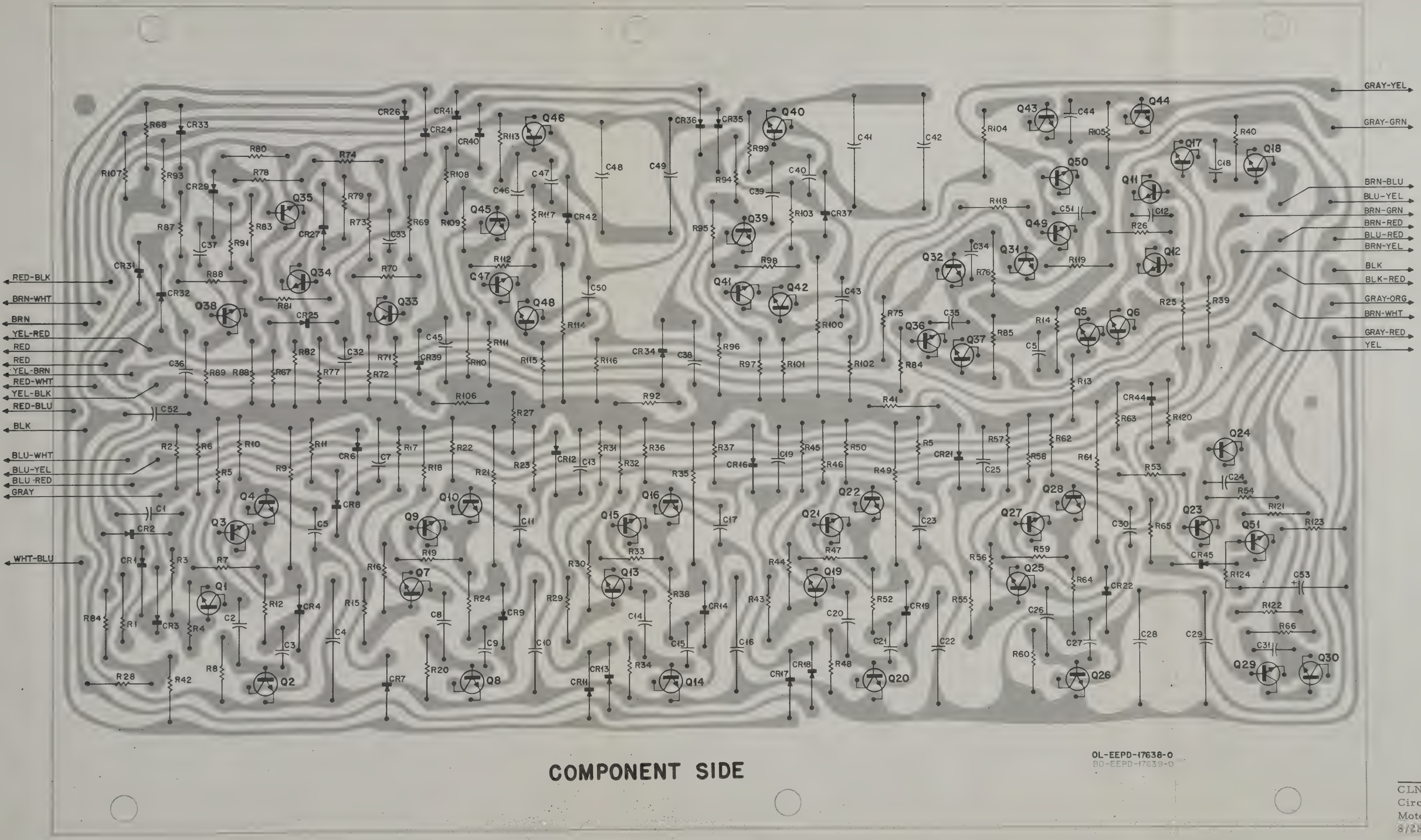
NOTE
Both readings are taken with the same meter (Motorola Model S1052B) and the DYNAMIC reading at some points may be an average reading of a pulsing voltage, while at other points may be a steady voltage.

EPD-21844-O

PREVIOUS REVISIONS AND PARTS LIST SHOWN ON FRONT OF THIS DIAGRAM

CLN6084B Auxiliary Function Decoder Board
Schematic Diagram
Motorola No. 63E81039A33-C1
8/28/68-RS


MOMENTARY DECODER OFF
MOMENTARY DECODER ON
TIME SLOT 2 DECODER
ALARM DECODER
ACTIVITY CHECK
BISTABLE DECODER
BISTABLE MULTIVIBRATOR
LOAD CONTROL DECODER OFF
LOAD CONTROL DECODER ON
RELAY DRIVER
HOLD CIRCUIT
"NAND" GATE
INVERTER
TIME DELAY
+3.9VDC
GND
ACTIVITY CHECK INPUT
BISTABLE DECODER OFF
BISTABLE DECODER ON
MOMENTARY DECODER OFF
MOMENTARY DECODER ON
TIME SLOT 2 DECODER
ALARM DECODER
LOAD CONTROL DECODER ON
LOAD CONTROL DECODER OFF
SWITCHED +3.9V
ACTIVITY RELAY
+18VDC
TRANSISTOR DETAILS (BOTTOM VIEW)
EMITTER
BASE
COLLECTOR


RED-BLK
BRN-WHT
BRN
YEL-RED
RED
RED
YEL-BRN
RED-WHT
YEL-BLK
RED-BLU
BLK
BLU-WHT
BLU-YEL
BLU-RED
GRAY
WHT-BLU
GRAY-YEL
GRAY-GRN
BRN-BLU
BLU-YEL
BRN-GRN
BRN-RED
BLU-RED
BRN-YEL
BLK
BLK-RED
GRAY-ORG
BRN-WHT
GRAY-RED
YEL
COMPONENT SIDE
OL-EEPD-17638-O
BD-EEPD-17639-O

CLN6084B-2 Auxiliary Function Decoder (Version II)
Circuit Board and Wiring Diagram
Motorola No. PEPD-17637-O
8/28/68-RS

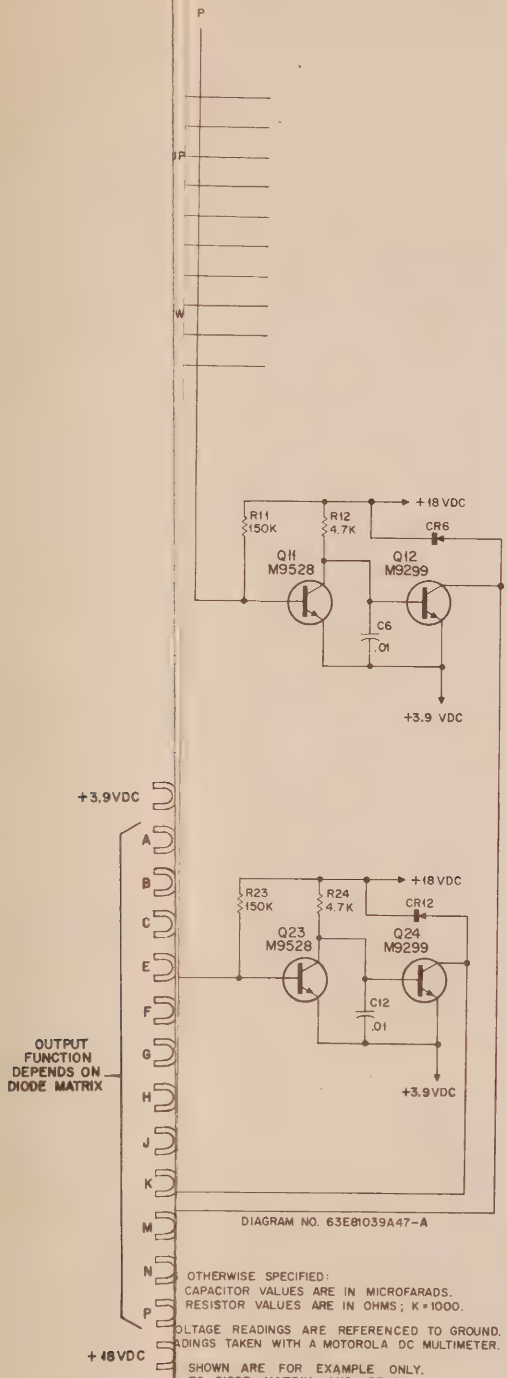


DIAGRAM NO. 63E81039A47-A

OTHERWISE SPECIFIED:
CAPACITOR VALUES ARE IN MICROFARADS.
RESISTOR VALUES ARE IN OHMS; K=1000.
OLTAGE READINGS ARE REFERENCED TO GROUND.
ADINGS TAKEN WITH A MOTOROLA DC MULTIMETER.
SHOWN ARE FOR EXAMPLE ONLY.
TO DIODE MATRIX AND RELAY
FOR SPECIFIC DIODE PLACEMENT.
IODES SHOWN CONNECTING TO INPUT LINES A AND
COMMON TO ALL STANDARD DIODE MATRICES.)

VOLTAGE READINGS

TRANSISTOR	BASE	EMITTER	COLLECTOR	SIGNAL CONDITION
Q1, 3, 5, 7, 9, 11, 13, 15, 17, 19, 21, 23	4.6	3.9	4.2	STATIC
	2.7	3.9	4.6	DYNAMIC
Q2, 4, 6, 8, 10, 12, 14, 16, 18, 20, 22, 24	4.2	3.9	18.0	STATIC
	4.6	3.9	4.0	DYNAMIC

NOTE: ALL VOLTAGE READINGS ARE
REFERENCED TO GROUND.

EPD-12237-O

In the VOLTAGE READINGS table the following two voltages are listed for each measuring point.

STATIC - Refers to the voltage appearing when there is no command being sent from the control transmitter unit.

DYNAMIC - Refers to the voltage appearing when a command is being sent that directly causes the circuit under test to respond normally.

NOTE

Both readings are taken with the same meter (Motorola Model S1052B) and the DYNAMIC reading at some points may be an average reading of a pulsing voltage, while at other points may be a steady voltage.

EPD-15607-O

PARTS LIST

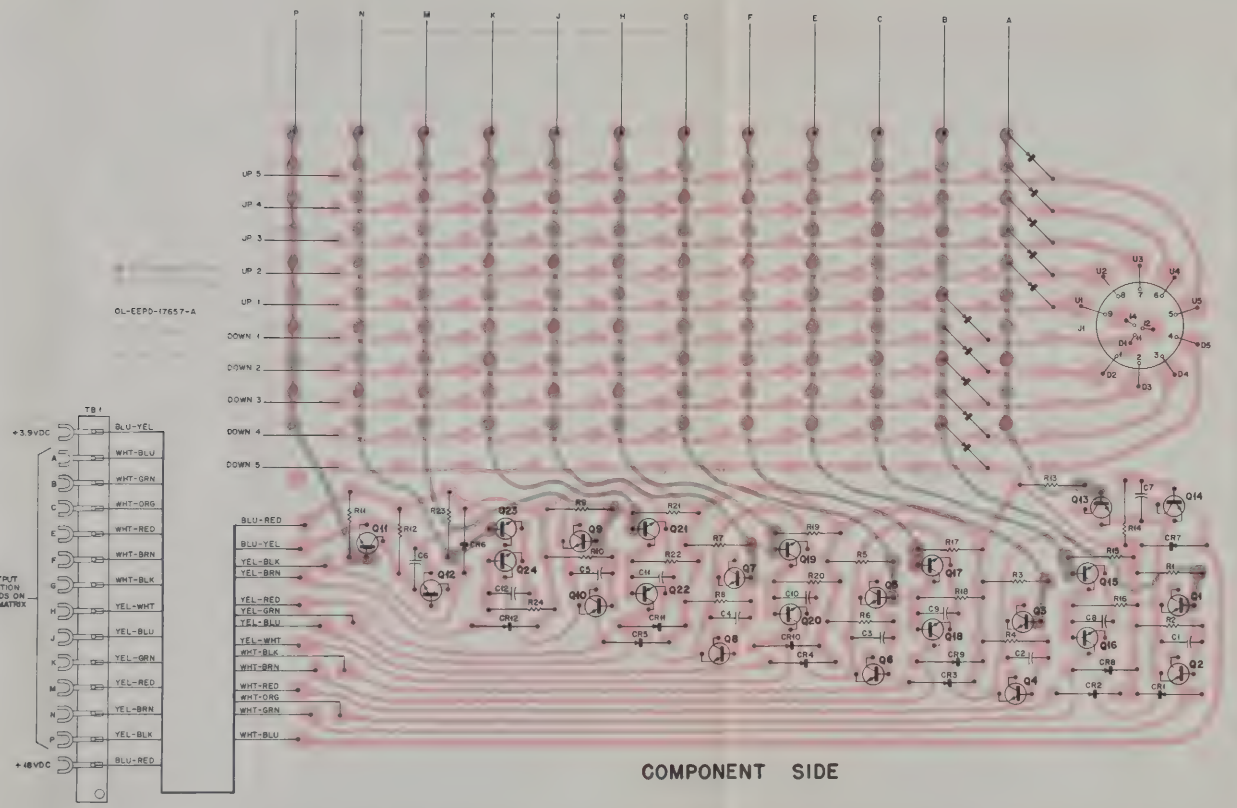
CLN6092A Basic Matrix Board EPD-13902-A

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
		CAPACITOR, fixed:
C1 thru 12	21D82428B58	.01 uf +80-20%; 500 v
		SEMICONDUCTOR DEVICE, diode: (NOTE)
CR1 thru 12	48C82392B03	silicon
		CONNECTOR, receptacle:
J1	9C82748G01	female; 12 cont.
		TRANSISTOR: N-P-N;
Q1, 3, 5, 7, 9, 11, 13, 15, 17, 19, 21, 23	48R869528	M9528
Q2, 4, 6, 8, 10, 12, 14, 16, 18, 20, 22, 24	48R869299	M9299
		RESISTOR, fixed: ±5%; 1/4 w:
R1, 3, 5, 7, 9, 11, 13, 15, 17, 19, 21, 23	6S129683	150K
R2, 4, 6, 8, 10, 12, 14, 16, 18, 20, 22, 24	6S129669	4.7K
		TERMINAL BOARD:
TB1	31B83079B03	14 spade lug terminals

NOTE:

Replacement diodes and transistors must be ordered by Motorola part number only for optimum performance.

CLN6092A Basic Matrix (p/o CLN1040A)
Schematic Diagram and Circuit Board Detail
Motorola No. PEPD-17640-A
8/28/68-RS


CL-EEPD-17657-A
TB1
+3.9VDC
+18VDC
OUTPUT FUNCTION DEPENDS ON DIODE MATRIX
UP 5
UP 4
UP 3
UP 2
UP 1
DOWN 1
DOWN 2
DOWN 3
DOWN 4
DOWN 5
J1
BLU-YEL
WHT-BLU
WHT-GRN
WHT-ORG
WHT-RED
WHT-BRN
WHT-BLK
YEL-WHT
YEL-BLU
YEL-GRN
YEL-RED
YEL-BRN
YEL-BLK
BLU-RED

COMPONENT SIDE

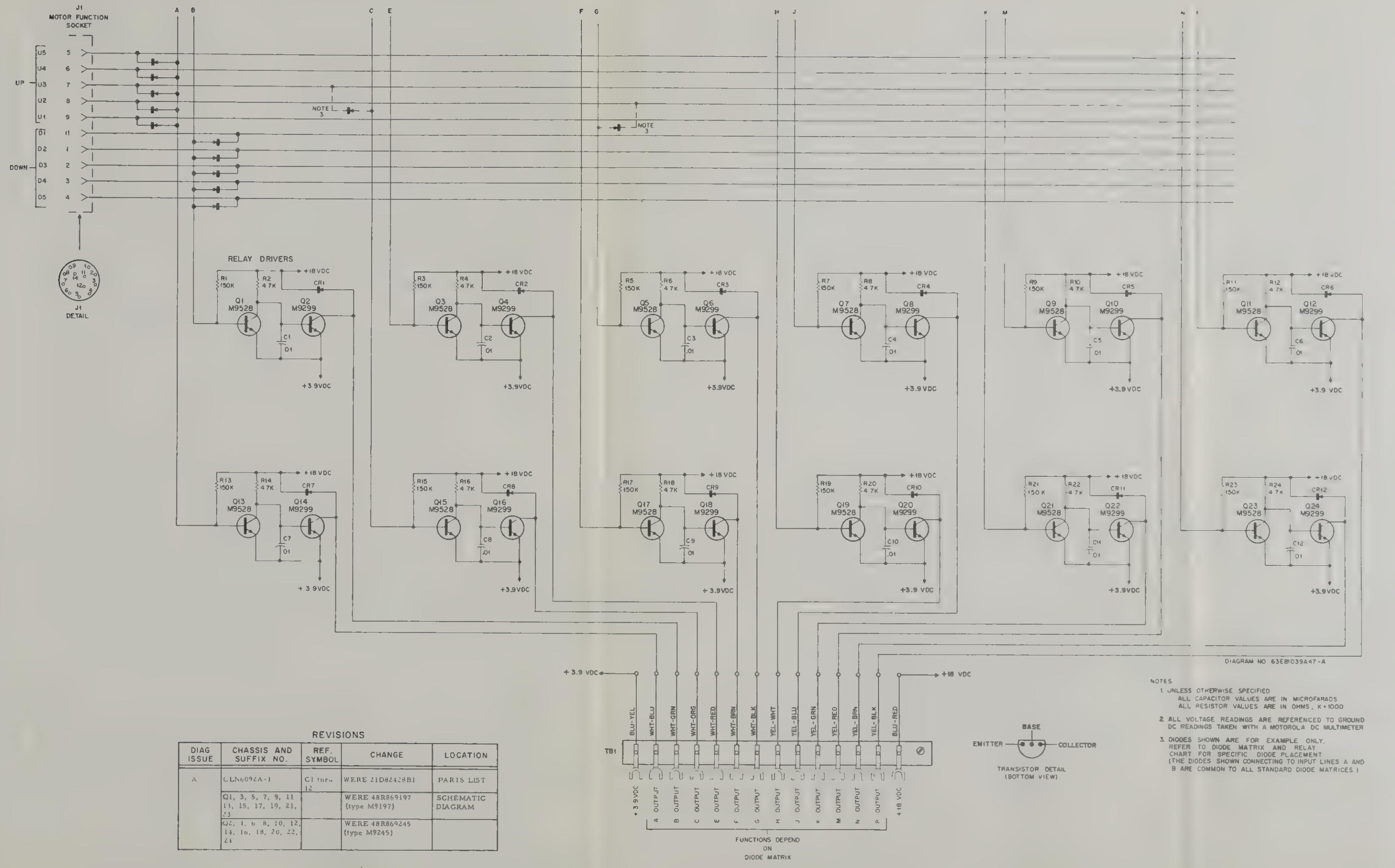

J1 MOTOR FUNCTION SOCKET
UP
DOWN
U5
U4
U3
U2
U1
D1
D2
D3
D4
D5
J1 DETAIL
NOTE 3
RELAY DRIVERS
+18 VDC
+3.9VDC
M9528
M9299
150K
4.7K
TB1
BASE
EMITTER
COLLECTOR
TRANSISTOR DETAIL (BOTTOM VIEW)
FUNCTIONS DEPEND ON DIODE MATRIX

DIAGRAM NO 63E81039A47-A

NOTES
1. UNLESS OTHERWISE SPECIFIED
ALL CAPACITOR VALUES ARE IN MICROFARADS
ALL RESISTOR VALUES ARE IN OHMS, K = 1000
2. ALL VOLTAGE READINGS ARE REFERENCED TO GROUND
DC READINGS TAKEN WITH A MOTOROLA DC MULTIMETER
3. DIODES SHOWN ARE FOR EXAMPLE ONLY.
REFER TO DIODE MATRIX AND RELAY CHART FOR SPECIFIC DIODE PLACEMENT
(THE DIODES SHOWN CONNECTING TO INPUT LINES A AND B ARE COMMON TO ALL STANDARD DIODE MATRICES)

REVISIONS

DIAG ISSUE	CHASSIS AND SUFFIX NO.	REF. SYMBOL	CHANGE	LOCATION
A	CLN6092A-1	C1 thru 12	WERE 21D82428B1	PARTS LIST
	Q1, 3, 5, 7, 9, 11 13, 15, 17, 19, 21, 23		WERE 48R869197 (type M9197)	SCHEMATIC DIAGRAM
	Q2, 4, 6, 8, 10, 12, 14, 16, 18, 20, 22, 24		WERE 48R869245 (type M9245)	

VOLTAGE READINGS

TRANSISTOR	BASE	EMITTER	COLLECTOR	SIGNAL CONDITION
Q1, 3, 5, 7, 9, 11, 13, 15, 17, 19, 21, 23	4.6	3.9	4.2	STATIC
	2.7	3.9	4.6	DYNAMIC
Q2, 4, 6, 8, 10, 12, 14, 16, 18, 20, 22, 24	4.2	3.9	18.0	STATIC
	4.6	3.9	4.0	DYNAMIC

NOTE: ALL VOLTAGE READINGS ARE REFERENCED TO GROUND.

EPD-12237-O

In the VOLTAGE READINGS table the following two voltages are listed for each measuring point.

STATIC - Refers to the voltage appearing when there is no command being sent from the control transmitter unit.

DYNAMIC - Refers to the voltage appearing when a command is being sent that directly causes the circuit under test to respond normally.

NOTE

Both readings are taken with the same meter (Motorola Model S1052B) and the DYNAMIC reading at some points may be an average reading of a pulsing voltage, while at other points may be a steady voltage.

EPD-15607-O

PARTS LIST

CLN6092A Basic Matrix Board EPD-13902-A

REFERENCE SYMBOL	MOTOROLA PART NO	DESCRIPTION
C1 thru 12	21D82428B58	CAPACITOR, fixed: .01 uf +80-20%; 500 v
CR1 thru 12	48C82392B03	SEMICONDUCTOR DEVICE, diode: (NOTE) silicon
J1	9C82748G01	CONNECTOR, receptacle: female, 12 cont.
Q1, 3, 5, 7, 9, 11, 13, 15, 17, 19, 21, 23	48R869528	TRANSISTOR: N-P-N; M9528
Q2, 4, 6, 8, 10, 12, 14, 16, 18, 20, 22, 24	48R869299	M9299
R1, 3, 5, 7, 9, 11, 13, 15, 17, 19, 21, 23	6S129683	RESISTOR, fixed: ±5%; 1/4 w; 150K
R2, 4, 6, 8, 10, 12, 14, 16, 18, 20, 22, 24	6S129669	4.7K
TB.	31B83079B03	TERMINAL BOARD: 14 spade lug terminals

NOTE:

Replacement diodes and transistors must be ordered by Motorola part number only for optimum performance.

CLN6092A Basic Matrix (p/o CLN1040A)
Schematic Diagram and Circuit Board Detail
Motorola No. PEPD-17640-A
8/28/68-RS

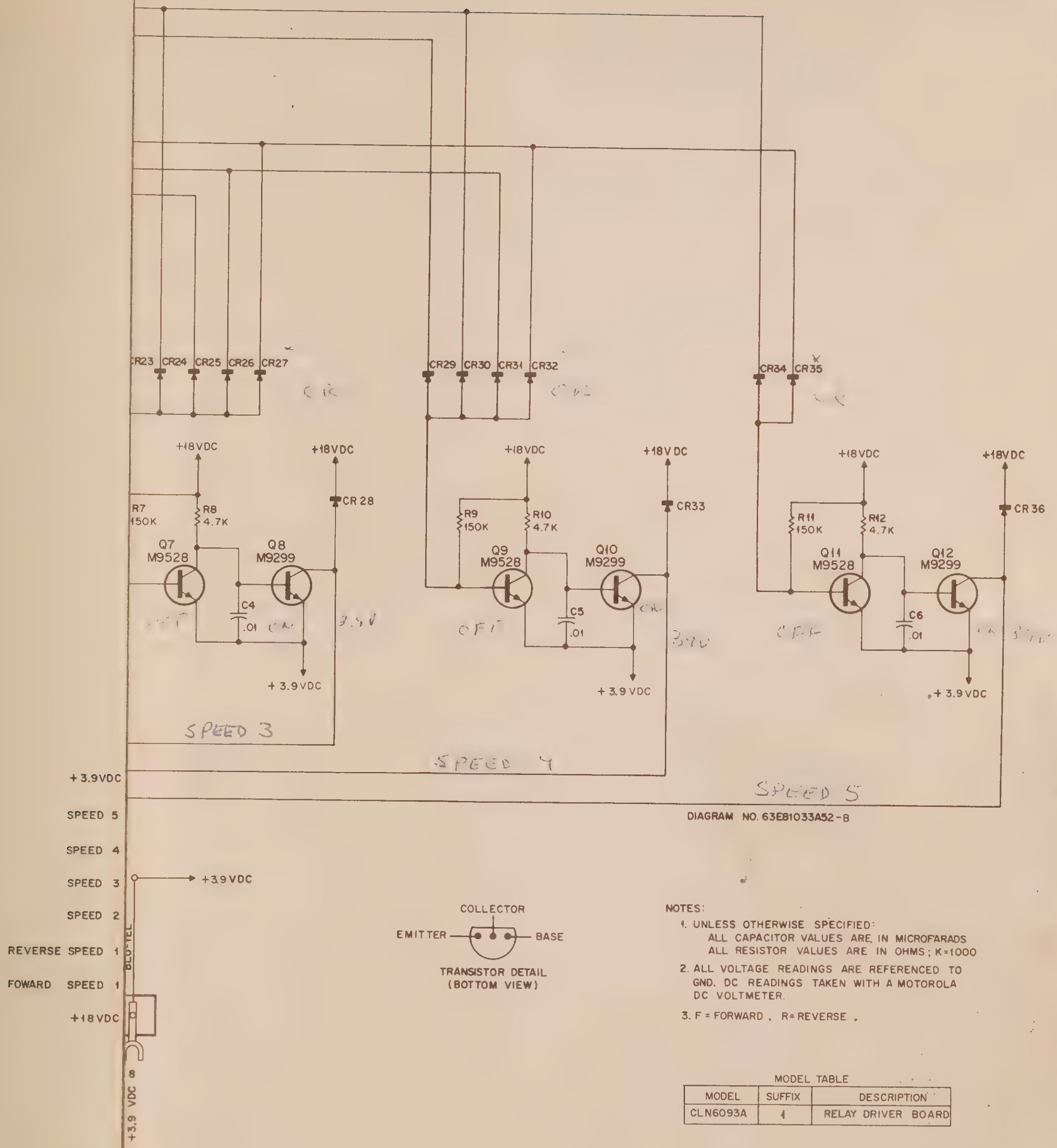

CR23
CR24
CR25
CR26
CR27
CR29
CR30
CR31
CR32
CR34
CR35
+18VDC
+18VDC
+18VDC
+18VDC
+18VDC
+18VDC
R7
150K
R8
4.7K
CR 28
Q7
M9528
Q8
M9299
C4
.01
3.9V
+ 3.9VDC
R9
150K
R10
4.7K
Q9
M9528
Q10
M9299
C5
.01
CR33
OFF
3.9V
+ 3.9 VDC
R11
150K
R12
4.7K
Q11
M9528
Q12
M9299
C6
.01
CR 36
OFF
+ 3.9 VDC
SPEED 3
SPEED 4
SPEED 5
+ 3.9VDC
SPEED 5
SPEED 4
SPEED 3
SPEED 2
REVERSE SPEED 1
FOWARD SPEED 1
+18VDC
+3.9VDC
BLU-YEL
8
+3.9 VDC
COLLECTOR
EMITTER
BASE
TRANSISTOR DETAIL
(BOTTOM VIEW)

DIAGRAM NO. 63E81033A52-B

NOTES:
1. UNLESS OTHERWISE SPECIFIED:
   ALL CAPACITOR VALUES ARE IN MICROFARADS
   ALL RESISTOR VALUES ARE IN OHMS; K=1000
2. ALL VOLTAGE READINGS ARE REFERENCED TO GND. DC READINGS TAKEN WITH A MOTOROLA DC VOLTMETER.
3. F = FORWARD , R= REVERSE .

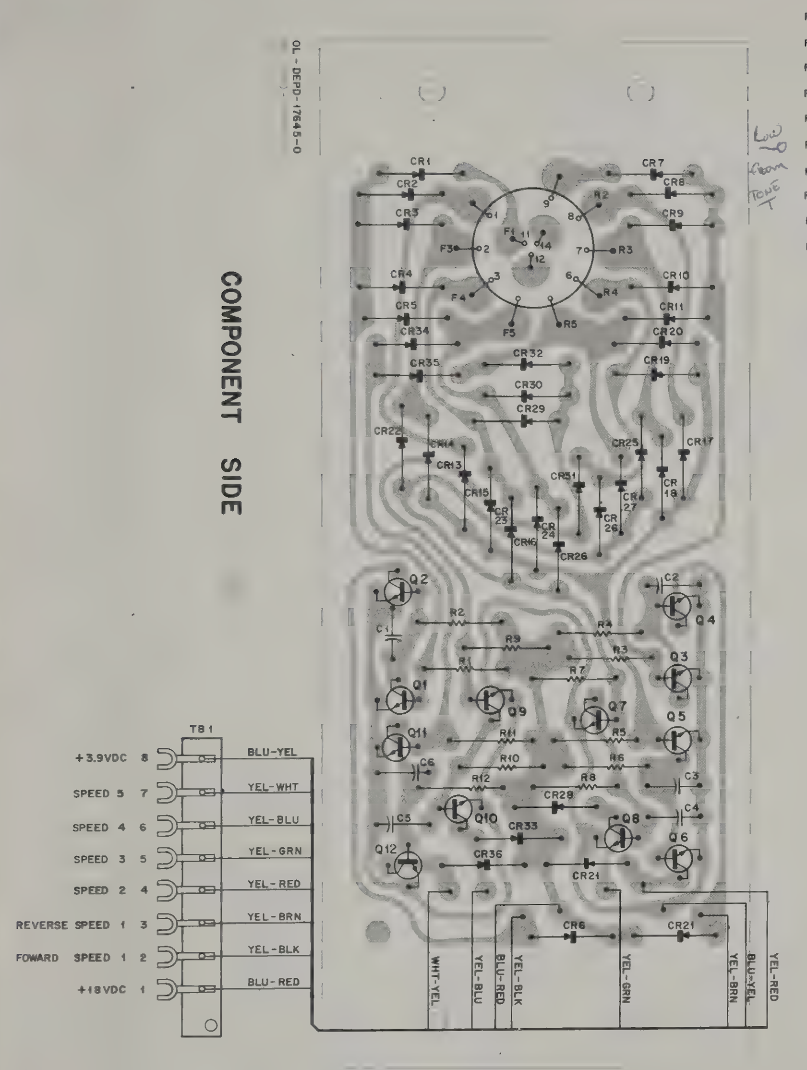
MODEL TABLE

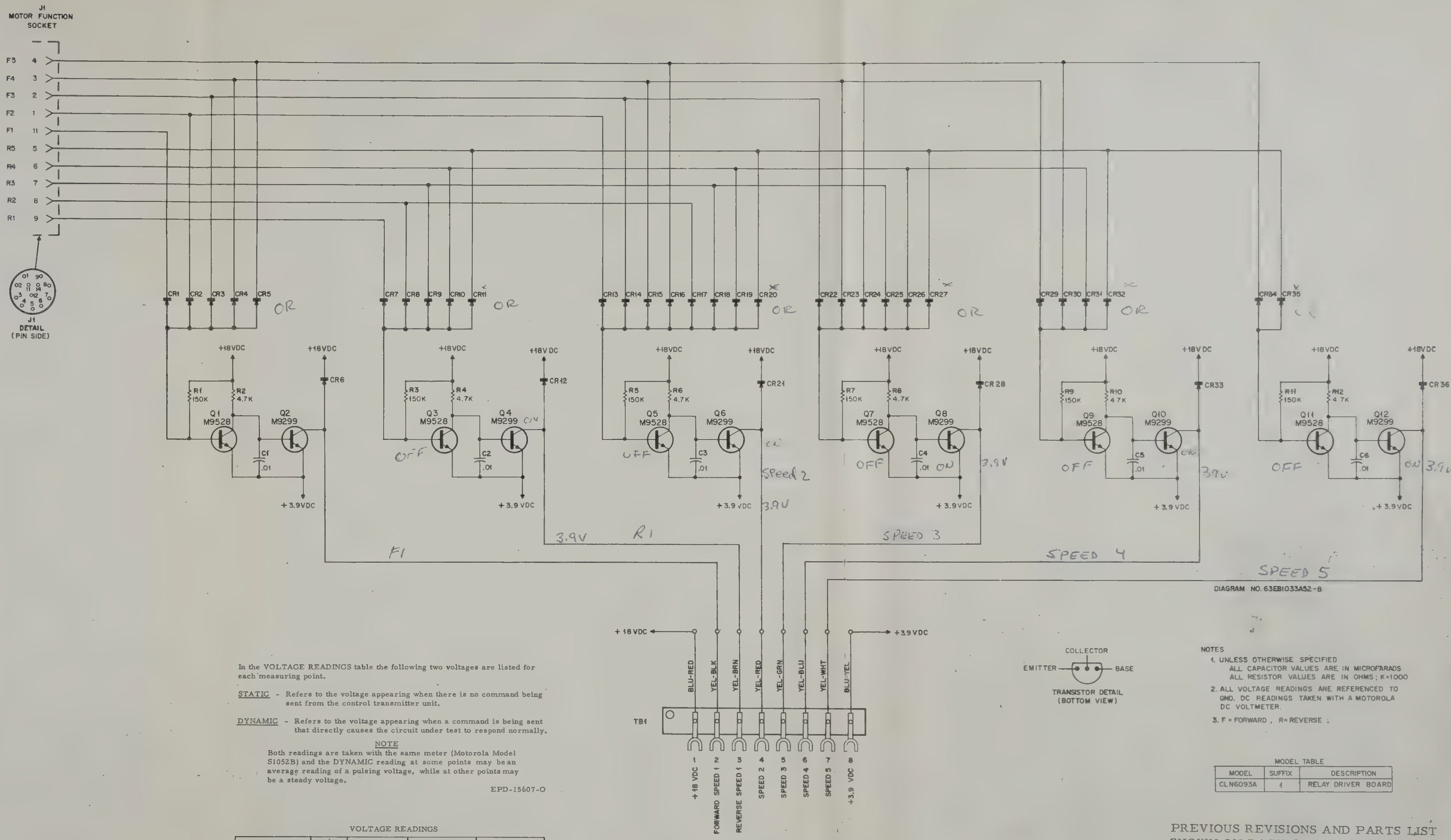
MODEL	SUFFIX	DESCRIPTION
CLN6093A	1	RELAY DRIVER BOARD

PREVIOUS REVISIONS AND PARTS LIST SHOWN ON BACK OF THIS DIAGRAM.

CLN6093A Relay Driver
Schematic Diagram and
Circuit Board Detail
Motorola No. PEPD-17643-A
8/28/68-RS

BRIDGE AND TROLLEY


OL-DEPD-17645-O
COMPONENT SIDE
TB1
+3.9VDC 8
SPEED 5 7
SPEED 4 6
SPEED 3 5
SPEED 2 4
REVERSE SPEED 1 3
FOWARD SPEED 1 2
+18VDC 1
BLU-YEL
YEL-WHT
YEL-BLU
YEL-GRN
YEL-RED
YEL-BRN
YEL-BLK
BLU-RED
WHT-YEL
YEL-BLU
BLU-RED
YEL-BLK
YEL-GRN
YEL-BRN
BLU-YEL
YEL-RED
CR1
CR2
CR3
CR4
CR5
CR7
CR8
CR9
CR10
CR11
CR34
CR20
CR35
CR32
CR30
CR29
CR19
CR22
CR14
CR13
CR15
CR25
CR17
CR31
CR23
CR24
CR16
CR27
CR18
CR26
CR28
CR33
CR36
CR21
CR6
Q1
Q2
Q3
Q4
Q5
Q6
Q7
Q8
Q9
Q10
Q11
Q12
R1
R2
R3
R4
R5
R6
R7
R8
R9
R10
R11
R12
C1
C2
C3
C4
C5
C6
F1
F2
F3
F4
F5
R2
R3
R4
R5
Low ~ from Tone T


J1 MOTOR FUNCTION SOCKET
F5 4
F4 3
F3 2
F2 1
F1 11
R5 5
R4 6
R3 7
R2 8
R1 9
J1 DETAIL (PIN SIDE)
CR1 CR2 CR3 CR4 CR5
OR
CR7 CR8 CR9 CR10 CR11
OR
CR13 CR14 CR15 CR16 CR17 CR18 CR19 CR20
OR
CR22 CR23 CR24 CR25 CR26 CR27
OR
CR29 CR30 CR31 CR32
OR
CR34 CR35
+18VDC
CR6
CR12
CR24
CR28
CR33
CR36
R1 150K
R2 4.7K
R3 150K
R4 4.7K
R5 150K
R6 4.7K
R7 150K
R8 4.7K
R9 150K
R10 4.7K
R11 150K
R12 4.7K
Q1 M9528
Q2 M9299
Q3 M9528
Q4 M9299
Q5 M9528
Q6 M9299
Q7 M9528
Q8 M9299
Q9 M9528
Q10 M9299
Q11 M9528
Q12 M9299
C1 .01
C2 .01
C3 .01
C4 .01
C5 .01
C6 .01
+3.9VDC
OFF
ON
3.9V
Speed 2
3.9V
F1
3.9V
R1
SPEED 3
SPEED 4
SPEED 5
DIAGRAM NO. 63EB1033A52-B
+18 VDC
+3.9 VDC
TB1
BLU-RED
YEL-BLK
YEL-BRN
YEL-RED
YEL-GRN
YEL-BLU
YEL-WHT
BLU-YEL
1 +18 VDC
2 FORWARD SPEED 1
3 REVERSE SPEED 1
4 SPEED 2
5 SPEED 3
6 SPEED 4
7 SPEED 5
8 +3.9 VDC
To Control Relays
Telephone Type
COLLECTOR
EMITTER
BASE
TRANSISTOR DETAIL (BOTTOM VIEW)

In the VOLTAGE READINGS table the following two voltages are listed for each measuring point.

STATIC - Refers to the voltage appearing when there is no command being sent from the control transmitter unit.

DYNAMIC - Refers to the voltage appearing when a command is being sent that directly causes the circuit under test to respond normally.

NOTE

Both readings are taken with the same meter (Motorola Model S1052B) and the DYNAMIC reading at some points may be an average reading of a pulsing voltage, while at other points may be a steady voltage.

EPD-15607-O

VOLTAGE READINGS

TRANSISTOR	BASE	EMITTER	COLLECTOR	SIGNAL CONDITION
Q1, 3, 5, 7, 9, 11	4.6	3.9	4.2	STATIC
	2.7	3.9	4.6	DYNAMIC
Q2, 4, 6, 8, 10, 12	4.2	3.9	18.0	STATIC
	4.6	3.9	4.0	DYNAMIC

NOTE: ALL VOLTAGE READINGS ARE REFERENCED TO GROUND.

EPD-12234-O

NOTES
1. UNLESS OTHERWISE SPECIFIED
   ALL CAPACITOR VALUES ARE IN MICROFARADS
   ALL RESISTOR VALUES ARE IN OHMS; K=1000
2. ALL VOLTAGE READINGS ARE REFERENCED TO GND. DC READINGS TAKEN WITH A MOTOROLA DC VOLTMETER.
3. F = FORWARD , R= REVERSE ;

MODEL TABLE

MODEL	SUFFIX	DESCRIPTION
CLN6093A	1	RELAY DRIVER BOARD

PREVIOUS REVISIONS AND PARTS LIST SHOWN ON BACK OF THIS DIAGRAM.

CLN6093A Relay Driver
Schematic Diagram and
Circuit Board Detail
Motorola No. PEPD-17643-A
8/28/68-RS

BRIDGE AND TROLLEY

VOLTAGE READINGS

TRANSISTOR OR REFERENCE POINT	BASE	EMITTER	COLLECTOR	OTHER	SIGNAL CONDITION
Q1, 101, 201, 301	5.0	4.3	4.4		STATIC
	5.5	5.0	5.6		DYNAMIC
Q2, 102, 202, 302	0.	0	0.5		STATIC
	-0.1	0	0.3		DYNAMIC
	0	0	1.3		FAULT
	0.9	1.9	2.6		STATIC
Q3, 103, 203, 303	0.7	1.9	2.6		DYNAMIC
	1.6	1.1	1.2		FAULT
Q4, 104, 204, 304	2.6	1.9	2.1		STATIC OR DYNAMIC
	1.2	1.1	13.6		FAULT
Junction of CR1 & R3, CR101 & R103, CR201 & R203, CR301 & R303				12.4	STATIC
				12.2	DYNAMIC
Junction of CR6 & R14				12.6	STATIC
				9.0	DYNAMIC
Junction of CR5, 105, 205, 305				12.1	STATIC & FAULT
				13.0	FAULT
TB1-3, TB1-4, TB1-5, TB1-6				0	STATIC
				18.0	DYNAMIC
				18.0	FAULT

NOTE: ALL VOLTAGE READINGS ARE
REFERENCED TO GROUND

EPD-21845-O

MODEL TABLE

MODEL	CHASSIS SUFFIX
CLN6151B	AUTOMATIC SAFETY OVERRIDE

EPD-13998-A

PREVIOUS REVISIONS AND PARTS LIST
SHOWN ON BACK OF THIS DIAGRAM

CLN6151B Automatic Safety Override
Schematic Diagram and Circuit Board Detail
Motorola No. PEPD-17646-A
8/28/68-RS ALL MOTOR FUNCTIONS

REVISIONS

DIAG ISSUE	CHASSIS AND SUFFIX NO	REF. SYMBOL	CHANGE	LOCATION
A	CLN6093A-1	C1 THRU 6	WERE 21D82428B11	PARTS LIST
		Q1, 3, 5, 7, 9, 11	WERE 48R869197	SCHEMATIC DIAGRAM
		Q2, 4, 6, 8, 10, 12	WERE 48R869245 (TYPE M9245)	

PARTS LIST

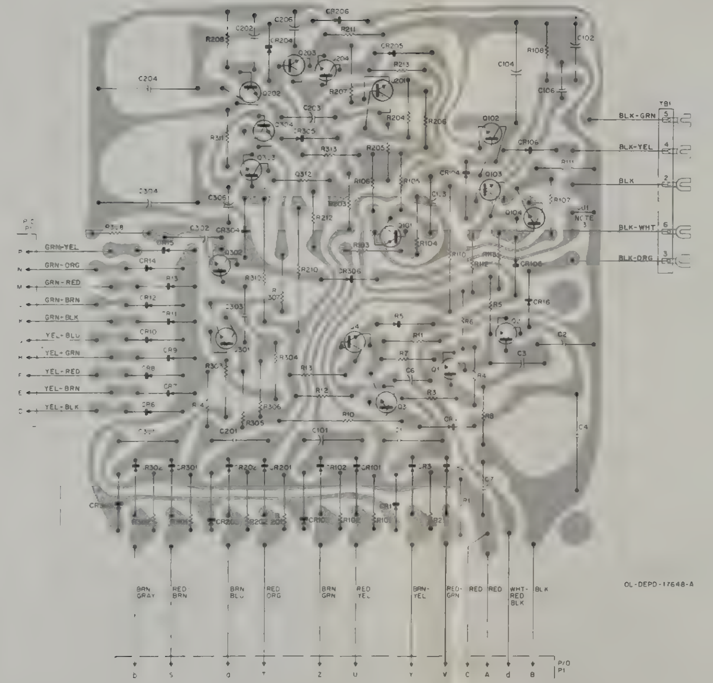
CLN6093A Relay Driver Circuit Board EPD-11629-B

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
		CAPACITOR, fixed:
C1 thru 6	21D82428B58	.01 uf +80-20%; 500 v
		SEMICONDUCTOR DEVICE, diode: (NOTE)
CR1 thru 36	48C82392B03	silicon
		CONNECTOR, receptacle:
J1	9C82748G01	female; 12 contact
		TRANSISTOR: (NOTE)
Q1, 3, 5, 7, 9, 11	48R869528	N-P-N; type M9528
Q2, 4, 6, 8, 10, 12	48R869299	N-P-N; type M9299
		RESISTOR, fixed:
R1, 3, 5, 7, 9, 11	6S128683	150K; 5%; 1/4 w
R2, 4, 6, 8, 10, 12	6S129669	4.7K; 5%; 1/4 w
		BOARD, terminal:
TB1	1V80748A45	incl. 31B83079B01 STRIP fanning; misc. leads (laced)

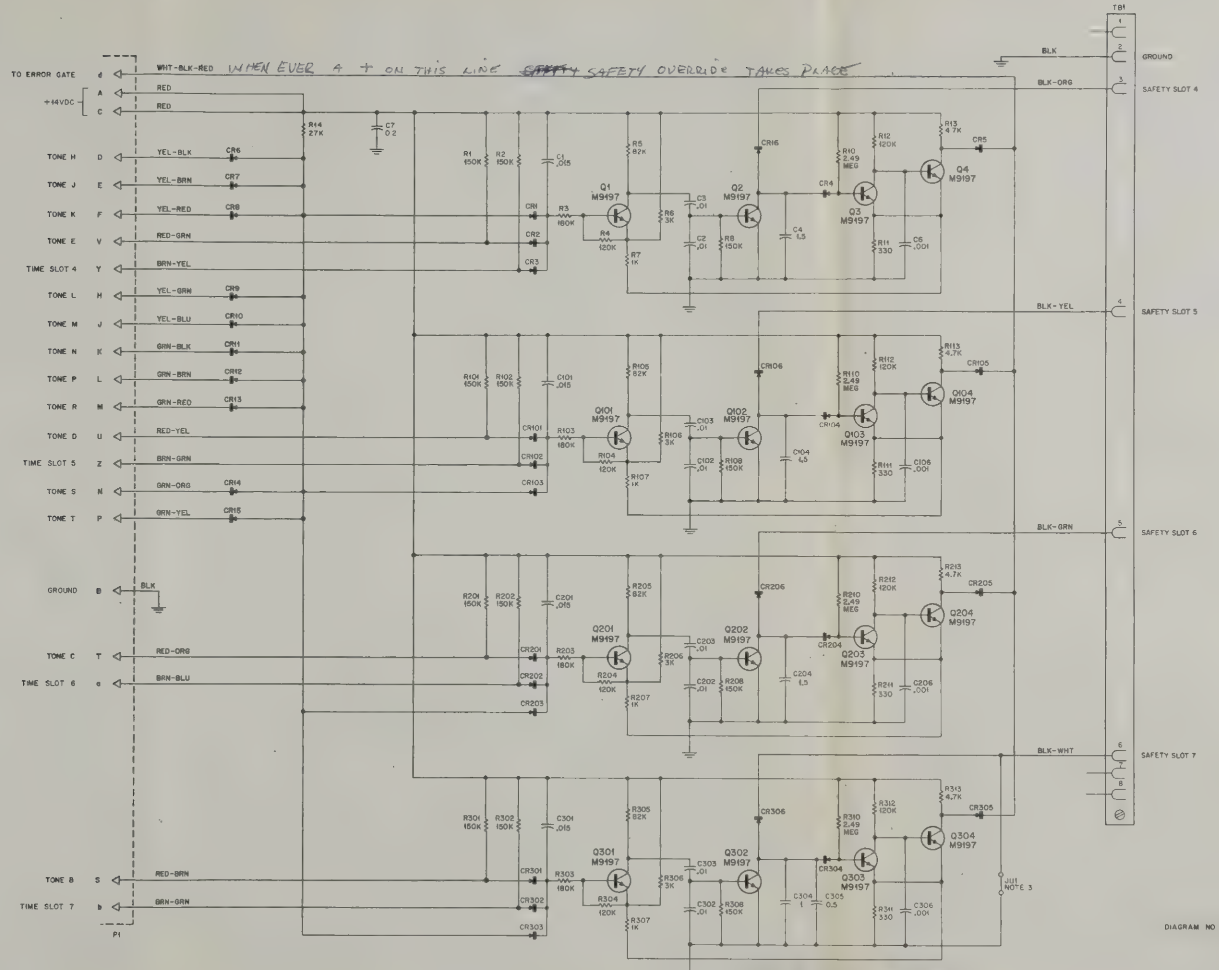
NOTE:

Replacement diodes and transistors must be ordered by Motorola part number only for optimum performance.

COMPONENT SIDE


TB1
BLK-GRN
BLK-YEL
BLK
BLK-WHT
BLK-ORG
GRN-YEL
GRN-ORG
GRN-RED
GRN-BRN
GRN-BLK
YEL-BLU
YEL-GRN
YEL-RED
YEL-BRN
YEL-BLK
BRN GRAY
RED BRN
BRN BLU
RED ORG
BRN GRN
RED YEL
GRN YEL
RED GRN
RED
WHT RED BLK
BLK
P1

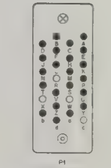
OL-DEPD-17648-A


TO ERROR GATE
+44VDC
WHT-BLK-RED
RED
TONE H
TONE J
TONE K
TONE E
TIME SLOT 4
TONE L
TONE M
TONE N
TONE P
TONE R
TONE D
TIME SLOT 5
TONE S
TONE T
GROUND
TONE C
TIME SLOT 6
TONE B
TIME SLOT 7
P1
TB1
GROUND
SAFETY SLOT 4
SAFETY SLOT 5
SAFETY SLOT 6
SAFETY SLOT 7
BLK
BLK-ORG
BLK-YEL
BLK-GRN
BLK-WHT
Q1 M9197
Q2 M9197
Q3 M9197
Q4 M9197
Q101 M9197
Q102 M9197
Q103 M9197
Q104 M9197
Q201 M9197
Q202 M9197
Q203 M9197
Q204 M9197
Q301 M9197
Q302 M9197
Q303 M9197
Q304 M9197
R14 27K
C7 0.2
NOTE 3

WHEN EVER 4 + ON THIS LINE ~~SAFETY~~ SAFETY OVERRIDE TAKES PLACE

MOTOR 4 + 5 [illegible] 7

DIAGRAM NO 63E81039448-02


P1
PLUG DETAIL

NOTES
1 ALL DIODES ARE RD1343
2 UNLESS OTHERWISE SPECIFIED
ALL RESISTOR VALUES ARE IN OHMS ±10%, 1/2W, K=1000
ALL CAPACITOR VALUES ARE IN MICROFARADS
3 CUT FOR 4 & 5 MOTOR SYSTEMS

VOLTAGE READINGS

TRANSISTOR OR REFERENCE POINT	BASE	EMITTER	COLLECTOR	OTHER	SIGNAL CONDITION
[illegible]	[illegible]	[illegible]	[illegible]		[illegible]
	[illegible]	[illegible]	[illegible]		[illegible]
Q2, 102, 202, 302	[illegible]	[illegible]	[illegible]		STATIC
	-0.1	0	0.3		DYNAMIC
	[illegible]	[illegible]	[illegible]		FAULT
[illegible]	[illegible]	[illegible]	[illegible]		STATIC
	[illegible]	[illegible]	[illegible]		DYNAMIC
	[illegible]	[illegible]	[illegible]		FAULT
[illegible]	[illegible]	[illegible]	[illegible]		STATIC OR DYNAMIC
	[illegible]	[illegible]	[illegible]	[illegible]	FAULT
Junction of CR1 & R3, CR101 & R103, CR201 & R203, CR301 & R303				[illegible]	[illegible]
				12.2	DYNAMIC
Junction of CR6 & R14				12.6	STATIC
				9.0	DYNAMIC
Junction of CR5, 105, 205, 305				[illegible]	[illegible]
				[illegible]	[illegible]
				[illegible]	[illegible]
TB1-3, TB1-4, TB1-5, TB1-6				[illegible]	[illegible]
				[illegible]	[illegible]
				[illegible]	[illegible]

NOTE: ALL VOLTAGE READINGS ARE REFERENCED TO GROUND

EPD 21845-O

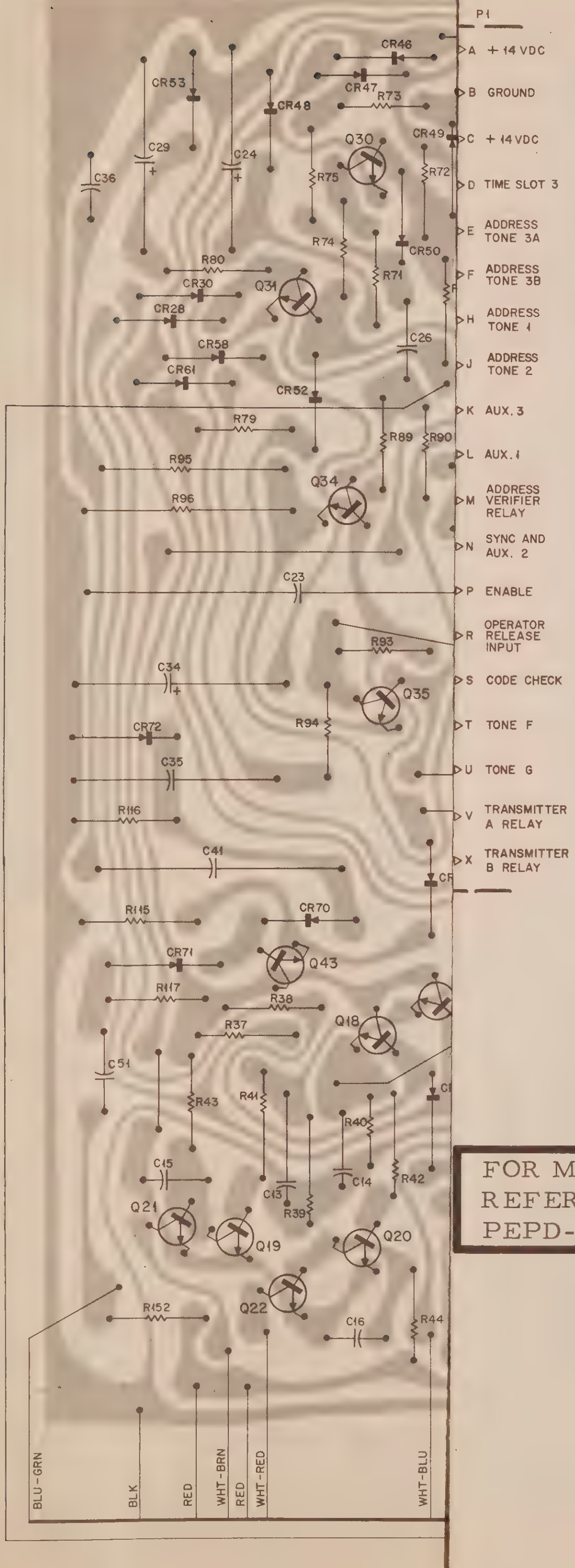
MODEL TABLE

MODEL	CHASSIS SUFFIX
CLN6151B	AUTOMATIC SAFETY OVERRIDE

EPD-13998-A

PREVIOUS REVISIONS AND PARTS LIST
SHOWN ON BACK OF THIS DIAGRAM

CLN6151B Automatic Safety Override
Schematic Diagram and Circuit Board Detail
Motorola No. PEPD-17646-A
8/28/68-RS ALL MOTOR FUNCTIONS


P1
A +14 VDC
B GROUND
C +14 VDC
D TIME SLOT 3
E ADDRESS TONE 3A
F ADDRESS TONE 3B
H ADDRESS TONE 1
J ADDRESS TONE 2
K AUX. 3
L AUX. 1
M ADDRESS VERIFIER RELAY
N SYNC AND AUX. 2
P ENABLE
R OPERATOR RELEASE INPUT
S CODE CHECK
T TONE F
U TONE G
V TRANSMITTER A RELAY
X TRANSMITTER B RELAY
CR46
CR47
R73
CR49
CR53
CR48
Q30
C29
C24
C36
R75
R72
R74
CR50
R71
R80
CR30
Q31
CR28
C26
CR58
CR61
CR52
R79
R89
R90
R95
Q34
R96
C23
R93
C34
Q35
R94
CR72
C35
R116
C41
R115
CR70
CR71
Q43
R117
R38
R37
Q18
C51
R43
R41
R40
C15
C13
C14
R42
R39
Q21
Q19
Q20
Q22
R152
C16
R44
BLU-GRN
BLK
RED
WHT-BRN
RED
WHT-RED
WHT-BLU

FOR MODEL CLN6167A WITH NO SUFFIX, REFER TO CIRCUIT BOARD DETAIL PEPD-17649.

EPD-20116-O

CLN6167A Operator Release
Circuit Board and Wiring Diagram
Motorola No. PEPD-20114-B
8/28/68-RS

REVISIONS

DIAG. ISSUE	CHASSIS AND SUFFIX NO.	REF. SYMBOL	CHANGE	LOCATION
A	CLN6151B		ADDED NOTE 3 AND VOLTAGE READINGS	DIAGRAM

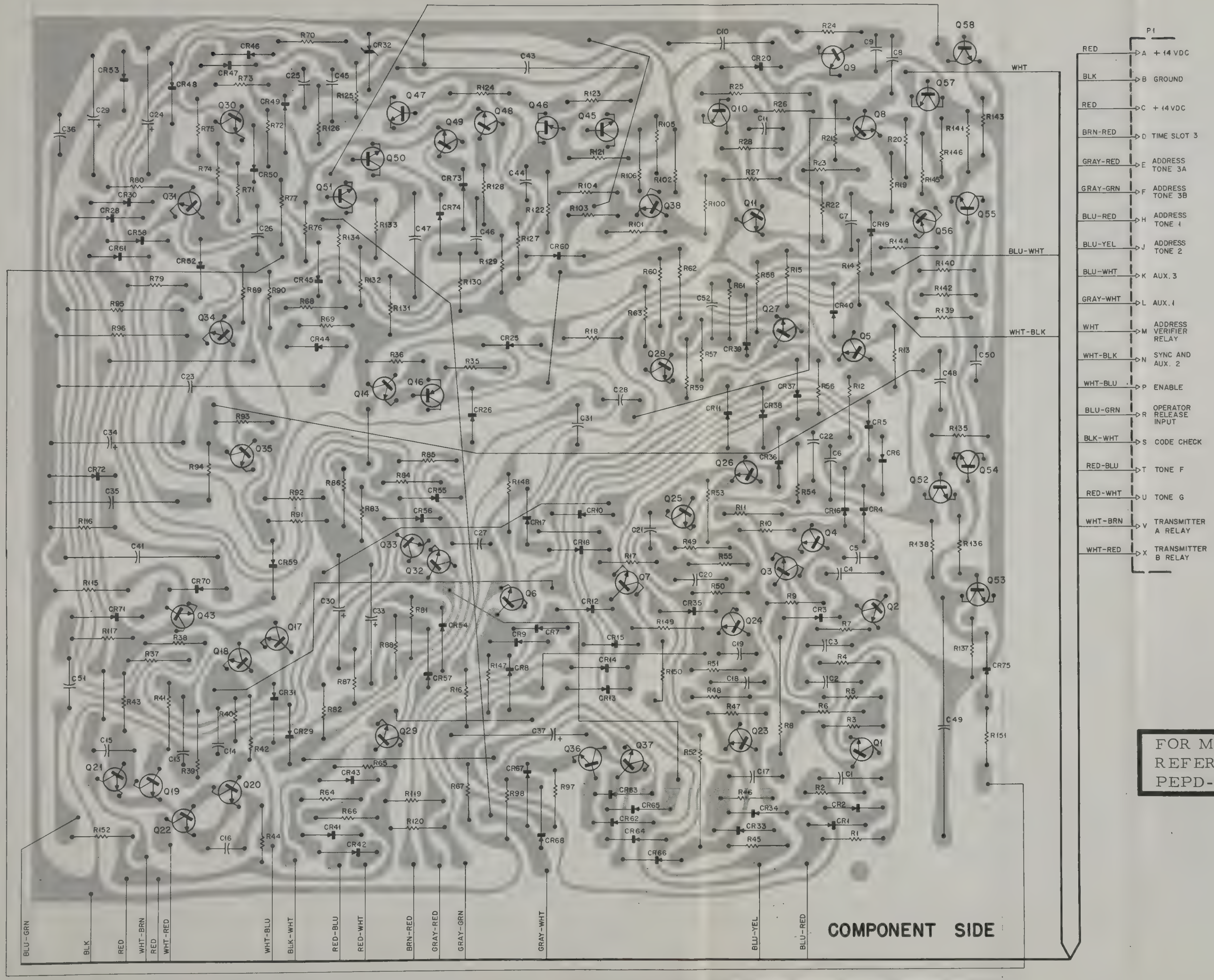
PARTS LIST

CLN6151B Automatic Safety Override EPD-13904-B

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
		CAPACITOR, fixed: uf; ±10%; unl stated
C1, 101, 201, 301	8D82905G10 or 8D83293B09	.015; 25 v .015; 50 v
C2, 3, 102, 103, 202, 203, 302, 303	8D82905G01 or 8D83293B06	.01; 25 v .01; 50 v
C4, 104, 204, 304	8D82045F02	1.5 uf; 100 v
C6, 106, 206, 306	21D82187B20	.001; 100 v
C7	21C82372C02	0.2 +80-20%; 25 v
		SEMICONDUCTOR DEVICE, diode: (NOTE)
CR1 to 15, 101 to 105, 201 to 205, 301 to 305	48C82392B03	silicon
		CONNECTOR, plug:
P1	1V80765A81	assy; male; 26 cont. incl. 14A83102B05 INSULATOR, conn 42A83312D01 CLIP (2 req'd.) 36A83313D01 KNOB (2 req'd.) 22B82637B02 PIN, drive 2 req'd. 3A83275D05 JACKSCREW (male) & 3A83275D06 JACKSCREW (female)
		TRANSISTOR: (NOTE)
Q1, 2, 3, 4, 101, 102, 103, 104, 201, 202, 203, 204, 301, 302, 303, 304	48R869197	N-P-N; M9197
		RESISTOR, fixed: ±5%; 1/4 w unl stated
R1, 2, 8, 101, 102, 108, 201, 202, 208, 301, 302, 308	6S128683	150K
R3, 103, 203, 303	6S124B04	180K
R4, 12, 104, 112, 204, 212, 304, 312	6S131446	120K
R5, 105, 205, 305	6S124A95	82K
R6, 106, 206, 306	6S124A60	3K
R7, 9, 107, 109 207, 209, 307, 309	6S129805	1K
R10, 110, 210, 310	6D82475B62	2.49 meg ±1%; 1/2 w
R11, 111, 211, 311	6S129806	330
R13, 113, 213, 313	6S129669	4.7K
R14	6S129886	27K
		TERMINAL BOARD:
TB1	31B83079B01	(fanning strip); 14 female cont. terminals

NOTE:

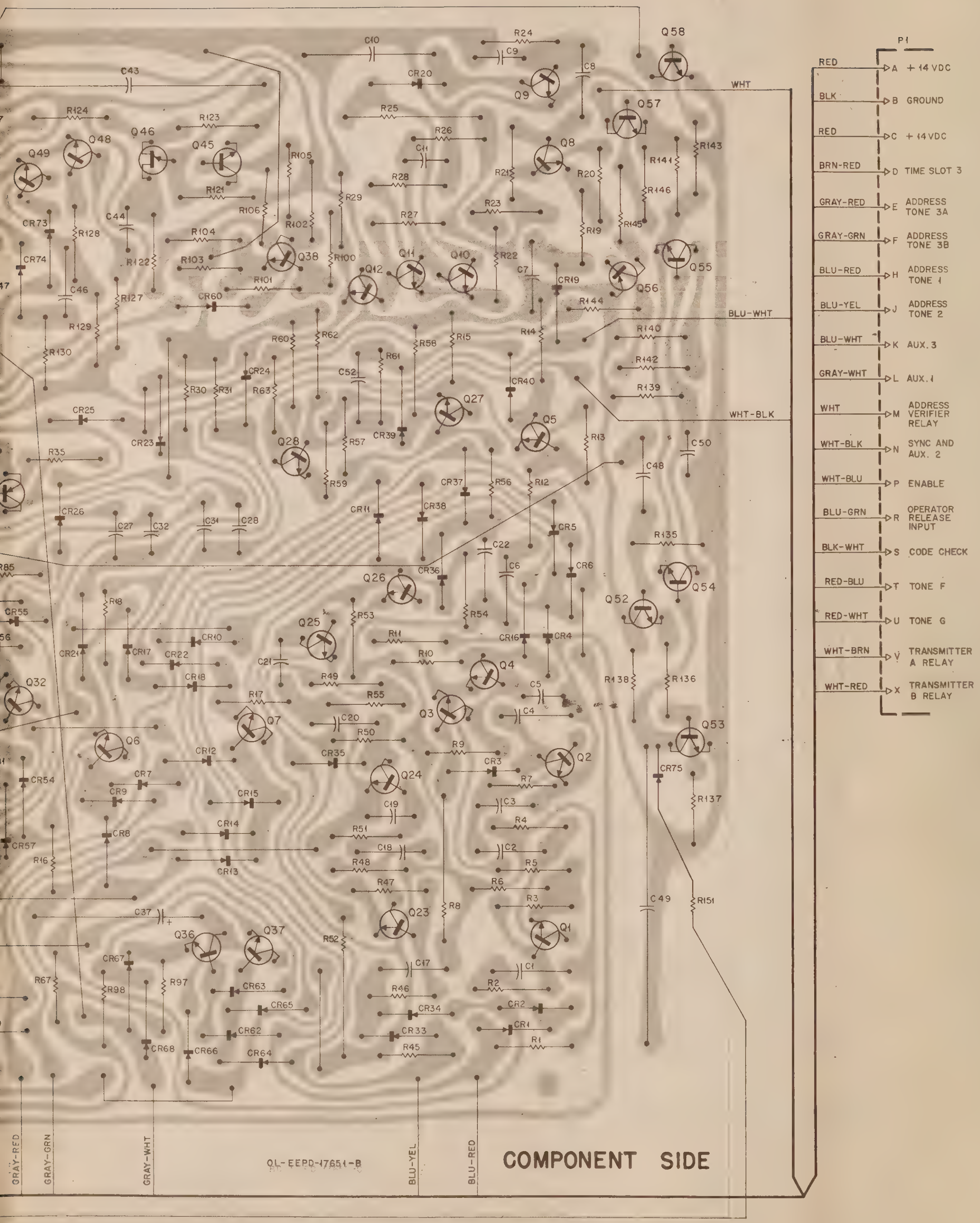
Replacement transistors and diodes must be ordered by Motorola part number only for optimum performance.


P1
RED A + 14 VDC
BLK B GROUND
RED C + 14 VDC
BRN-RED D TIME SLOT 3
GRAY-RED E ADDRESS TONE 3A
GRAY-GRN F ADDRESS TONE 3B
BLU-RED H ADDRESS TONE 1
BLU-YEL J ADDRESS TONE 2
BLU-WHT K AUX. 3
GRAY-WHT L AUX. 1
WHT M ADDRESS VERIFIER RELAY
WHT-BLK N SYNC AND AUX. 2
WHT-BLU P ENABLE
BLU-GRN R OPERATOR RELEASE INPUT
BLK-WHT S CODE CHECK
RED-BLU T TONE F
RED-WHT U TONE G
WHT-BRN V TRANSMITTER A RELAY
WHT-RED X TRANSMITTER B RELAY
WHT
BLU-WHT
WHT-BLK
BLU-GRN
BLK
RED
WHT-BRN
RED
WHT-RED
WHT-BLU
BLK-WHT
RED-BLU
RED-WHT
BRN-RED
GRAY-RED
GRAY-GRN
GRAY-WHT
BLU-YEL
BLU-RED
COMPONENT SIDE

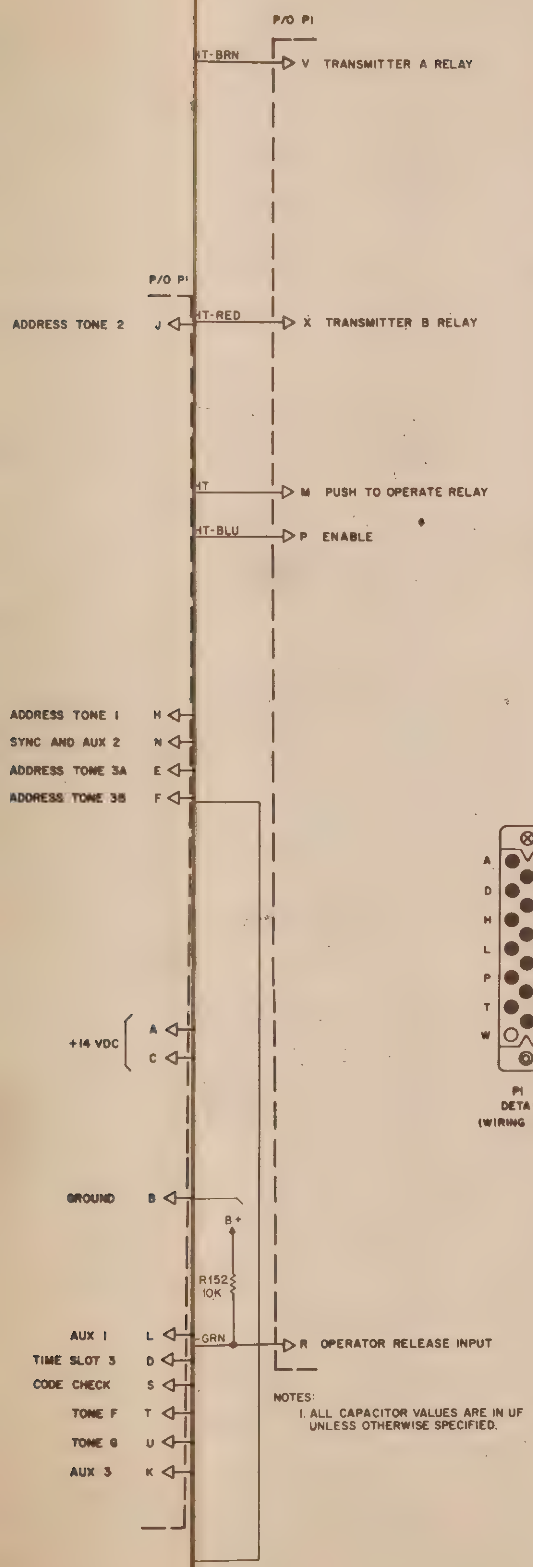
FOR MODEL CLN6167A WITH NO SUFFIX,
REFER TO CIRCUIT BOARD DETAIL
PEPD-17649.

EPD-20116-O

CLN6167A Operator Release
Circuit Board and Wiring Diagram
Motorola No. PEPD-20114-B
8/28/68-RS


P1
RED A + 14 VDC
BLK B GROUND
RED C + 14 VDC
BRN-RED D TIME SLOT 3
GRAY-RED E ADDRESS TONE 3A
GRAY-GRN F ADDRESS TONE 3B
BLU-RED H ADDRESS TONE 1
BLU-YEL J ADDRESS TONE 2
BLU-WHT K AUX. 3
GRAY-WHT L AUX. 1
WHT M ADDRESS VERIFIER RELAY
WHT-BLK N SYNC AND AUX. 2
WHT-BLU P ENABLE
BLU-GRN R OPERATOR RELEASE INPUT
BLK-WHT S CODE CHECK
RED-BLU T TONE F
RED-WHT U TONE G
WHT-BRN V TRANSMITTER A RELAY
WHT-RED X TRANSMITTER B RELAY
WHT
BLU-WHT
WHT-BLK
GRAY-RED
GRAY-GRN
GRAY-WHT
BLU-YEL
BLU-RED
QL-EEPD-17651-B
Q1 Q2 Q3 Q4 Q5 Q6 Q7 Q8 Q9 Q10 Q11 Q12 Q23 Q24 Q25 Q26 Q27 Q28 Q32 Q36 Q37 Q38 Q45 Q46 Q48 Q49 Q52 Q53 Q54 Q55 Q56 Q57 Q58

COMPONENT SIDE


P/O P1
HT-BRN
V TRANSMITTER A RELAY
P/O P1
ADDRESS TONE 2
J
HT-RED
X TRANSMITTER B RELAY
HT
M PUSH TO OPERATE RELAY
HT-BLU
P ENABLE
ADDRESS TONE 1
H
SYNC AND AUX 2
N
ADDRESS TONE 3A
E
ADDRESS TONE 3B
F
+14 VDC
A
C
GROUND
B
B+
R152
10K
AUX 1
L
GRN
R OPERATOR RELEASE INPUT
TIME SLOT 3
D
CODE CHECK
S
TONE F
T
TONE G
U
AUX 3
K

NOTES:
1. ALL CAPACITOR VALUES ARE IN UF UNLESS OTHERWISE SPECIFIED.

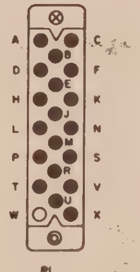
VOLTAGE READINGS

TRANSISTOR	BASE	EMITTER	COLLECTOR	CONDITION S = STATIC D = DYNAMIC
Q1, 5, 8,	5	4	4.4	S
23, 27	5.5	5.0	5.6	D
Q2, 9, 24	0	0	1.3	S
	-0.1	0	0.9	D
Q3, 10,	1.6	1.1	1.2	S
25	1.3	1.9	2.6	D
Q4, 11,	1.2	1.1	12.2	S
26	2.6	1.9	2.1	D
Q6, 7	13.0	12.4	13.6	S
	12.0	11.4	13.6	D
Q13	0.7	0	0.1	S
	0.3	0	1.5	D
Q14	11.3	10.7	13.6	S
	7.2	6.6	13.6	D
Q15	0.1	0	13.6	S
	1.5	0.8	0.9	D
Q16	10.7	11.2	0	S
	6.6	7.2	0	D
Q17, 18	1.5	.9	13.6	S
	12.4	11.8	13.6	D
Q19, 20	4.6	3.9	4.0	S
	2.1	3.9	4.7	D
Q21, 22	4.0	3.9	18.0	S
	4.7	3.9	4.0	D
Q28	1.2	2.2	12.2	S
	1.25	2.2	10.5	D
Q29	12.4	11.8	13.6	S
	9.2	8.6	13.6	D
Q30	.15	0.6	12.0	S
	1.2	0.6	0.7	D

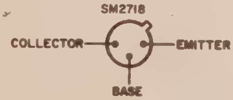
TRANSISTOR	BASE	EMITTER	COLLECTOR	CONDITION S = STATIC D = DYNAMIC
Q31	1.2	0.6	0.7	S
	0.15	0.6	12.0	D
Q32, 33	1.5	0.6	12.0	NOTE 2
	1.2	0.6	0.7	
Q34	5.7	5.1	5.2	S
	2.7	5.1	12.0	D
Q35	2.7	5.1	12.0	S
	5.7	5.1	5.2	D
Q36, 37	11.9	11.3	13.0	S
	10.8	10.2	13.0	D
Q38	4.3	3.7	3.8	S
	2.7	3.7	13.3	D
Q39	DO NOT MEASURE SEE NOTE 1			
Q40	(1)3.9 (2)13.0	NOTE 1	----	S
	(1)3.9 (2)13.0	4.0	----	D
Q41	4.0	3.9	13.6	S
	4.0	3.9	13.6	D
Q42	(1)0 (2)13.0	5.1	----	S
	(1)0 (2)13.0	5.1	----	D
Q43	13.1	12.4	13.6	S
	13.1	12.4	13.6	D
Q44	DO NOT MEASURE SEE NOTE 1			

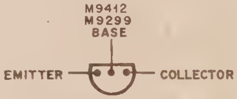
NOTES:
1. VERY HIGH IMPEDANCE CIRCUIT. VOLTAGE CANNOT BE MEASURED BY ORDINARY MEANS.
2. Q32 AND Q33 MAY ASSUME EITHER OF THE VOLTAGE CONDITIONS SHOWN.

EPD-15631-A

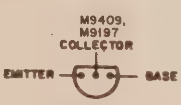

A
C
B
D
F
E
H
K
J
L
N
M
P
S
R
T
V
U
W
X

P1
DETAIL
(WIRING SIDE)

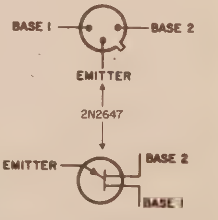

SM2718
COLLECTOR
EMITTER
BASE


M9412
M9299
BASE
EMITTER
COLLECTOR

TRANSISTOR DETAIL
(BOTTOM VIEW)


M9409,
M9197
COLLECTOR
EMITTER
BASE

TRANSISTOR DETAIL
(BOTTOM VIEW)


BASE 1
BASE 2
EMITTER
2N2647
EMITTER
BASE 2
BASE 1

UNIJUNCTION TRANSISTOR DETAIL

MODEL TABLE

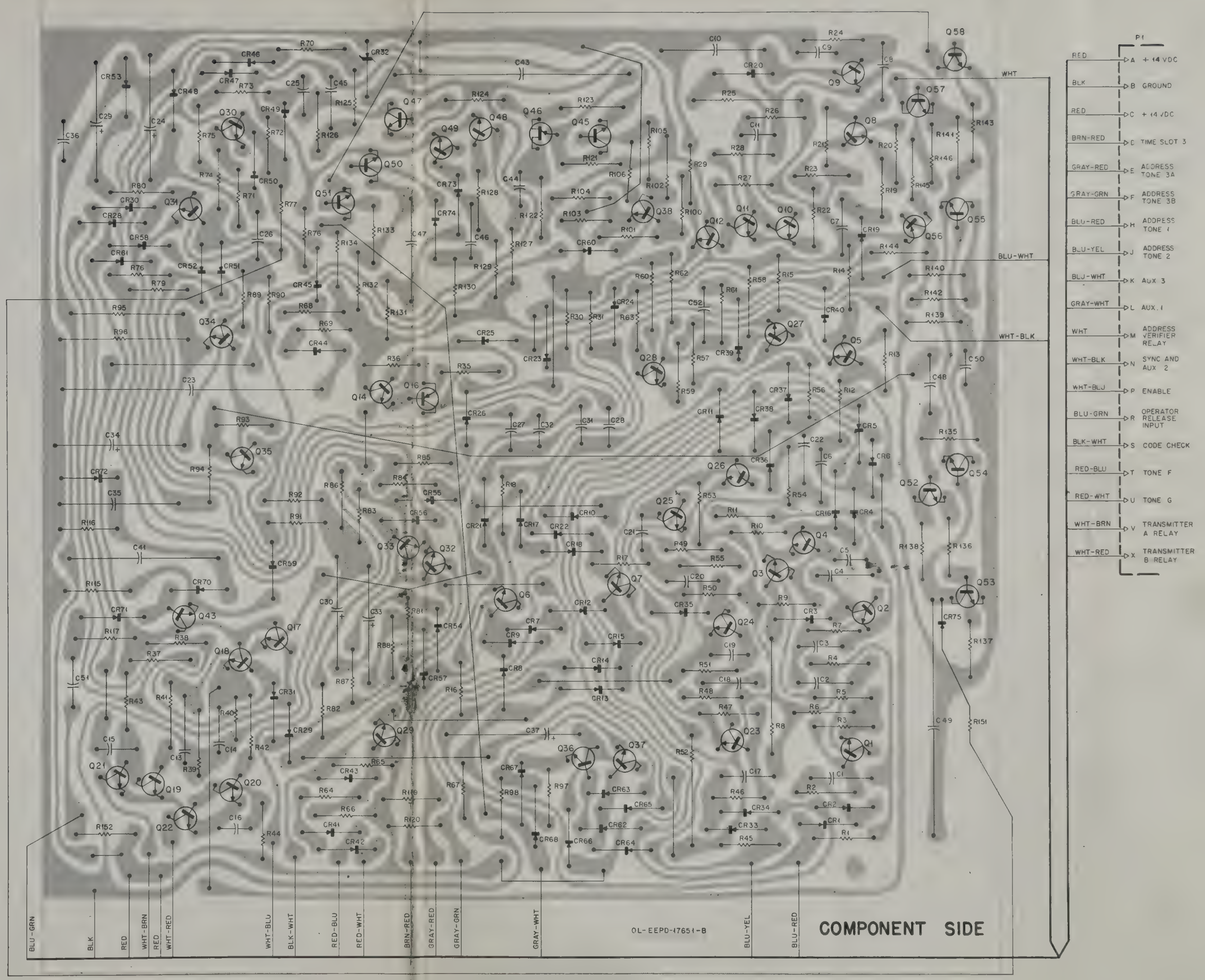
MODEL	SUFFIX	DESCRIPTION
CLN6167A	3	OPERATOR RELEASE KIT

PREVIOUS REVISIONS AND PARTS LIST
SHOWN ON BACK OF THIS DIAGRAM

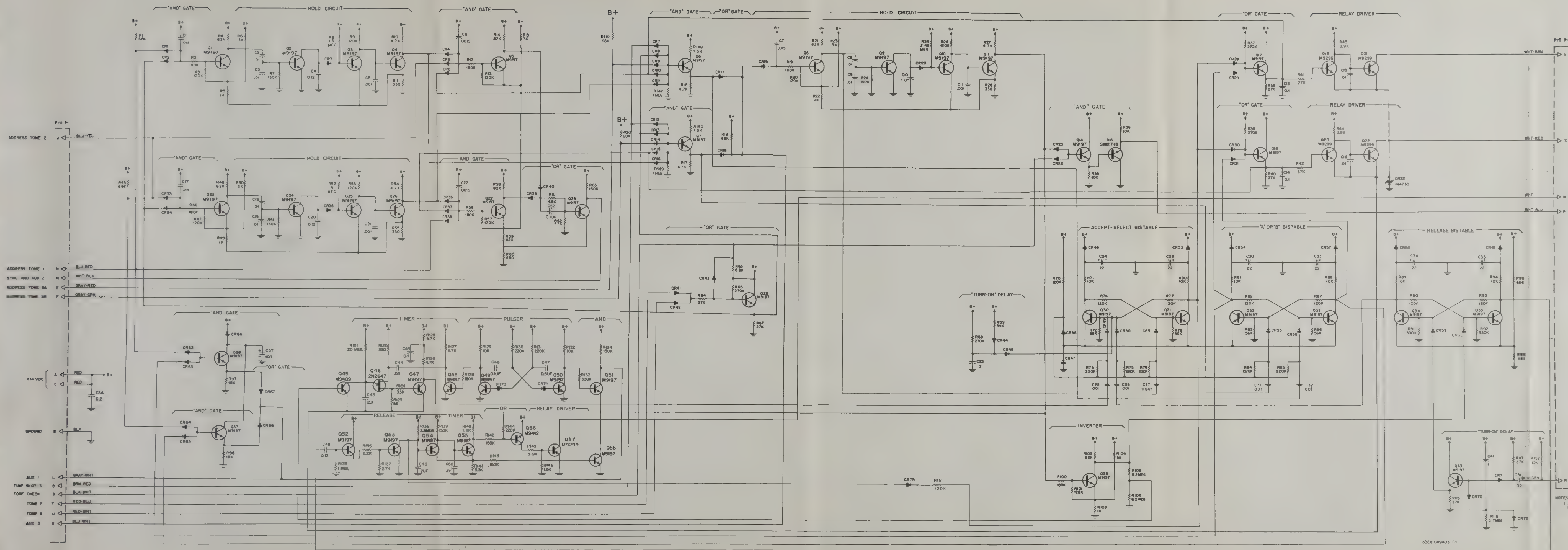
CLN6167A Operator Release
Schematic Diagram
Motorola No. 63E81049A03-C1
8/28/68-RS

FOR MODEL CLN6167A SUFFIX-1, REFER TO CIRCUIT BOARD DETAIL PEPD-20114.

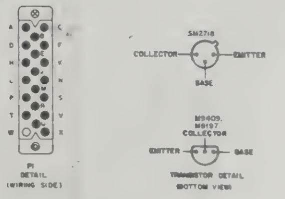
EPD-20120-O

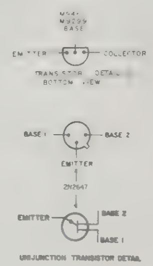

P1
RED
A + 14 VDC
BLK
B GROUND
RED
C + 14 VDC
BRN-RED
D TIME SLOT 3
GRAY-RED
E ADDRESS TONE 3A
GRAY-GRN
F ADDRESS TONE 3B
BLU-RED
H ADDRESS TONE 1
BLU-YEL
J ADDRESS TONE 2
BLU-WHT
K AUX 3
GRAY-WHT
L AUX. 1
WHT
M ADDRESS VERIFIER RELAY
WHT-BLK
N SYNC AND AUX 2
WHT-BLU
P ENABLE
BLU-GRN
R OPERATOR RELEASE INPUT
BLK-WHT
S CODE CHECK
RED-BLU
T TONE F
RED-WHT
U TONE G
WHT-BRN
V TRANSMITTER A RELAY
WHT-RED
X TRANSMITTER B RELAY
WHT
BLU-WHT
WHT-BLK
BLU-GRN
BLK
RED
WHT-BRN
RED
WHT-RED
WHT-BLU
BLK-WHT
RED-BLU
RED-WHT
BRN-RED
GRAY-RED
GRAY-GRN
GRAY-WHT
BLU-YEL
BLU-RED
OL-EEPD-17651-B
COMPONENT SIDE

CLN6167A Operator Release
Circuit Board and Wiring Diagram
Motorola No. PEPD-17649-B
8/28/68-RS


"AND" GATE
HOLD CIRCUIT
"AND" GATE
"AND" GATE
"OR" GATE
HOLD CIRCUIT
"OR" GATE
RELAY DRIVER
"AND" GATE
"AND" GATE
"OR" GATE
RELAY DRIVER
"AND" GATE
HOLD CIRCUIT
AND GATE
"OR" GATE
"OR" GATE
ACCEPT-SELECT BISTABLE
"A" OR "B" BISTABLE
RELEASE BISTABLE
"TURN-ON" DELAY
"AND" GATE
"OR" GATE
"AND" GATE
TIMER
PULSER
AND
RELEASE
TIMER
OR
RELAY DRIVER
INVERTER
"TURN-ON" DELAY
B+
P/O P1
ADDRESS TONE 2 J BLU-YEL
ADDRESS TONE 1 N BLU-RED
SYNC AND AUX 2 H WHT-BLK
ADDRESS TONE 3A E GRAY-RED
ADDRESS TONE 3B F GRAY-GRN
+14 VDC A RED C RED
C36 0.2
GROUND B BLK
AUX 1 L GRAY-WHT
TIME SLOT 3 D BRN RED
CODE CHECK S BLK-WHT
TONE F T RED-BLU
TONE 6 U RED-WHT
AUX 3 K BLU-WHT
WHT-BRN V TRANSMITTER A RELAY
WHT-RED X TRANSMITTER B RELAY
WHT M PUSH TO OPERATE RELAY
WHT BLU P ENABLE
BLU GRN R OPERATOR RELEASE INPUT
63E81049A03 C1

NOTES:
1 ALL CAPACITOR VALUES ARE IN UF UNLESS OTHERWISE SPECIFIED


A
C
D
F
H
K
L
N
P
S
T
V
W
X
P1
DETAIL
(WIRING SIDE)
SM2718
COLLECTOR
EMITTER
BASE
M9409,
M9197
COLLECTOR
EMITTER
BASE
TRANSISTOR DETAIL
(BOTTOM VIEW)

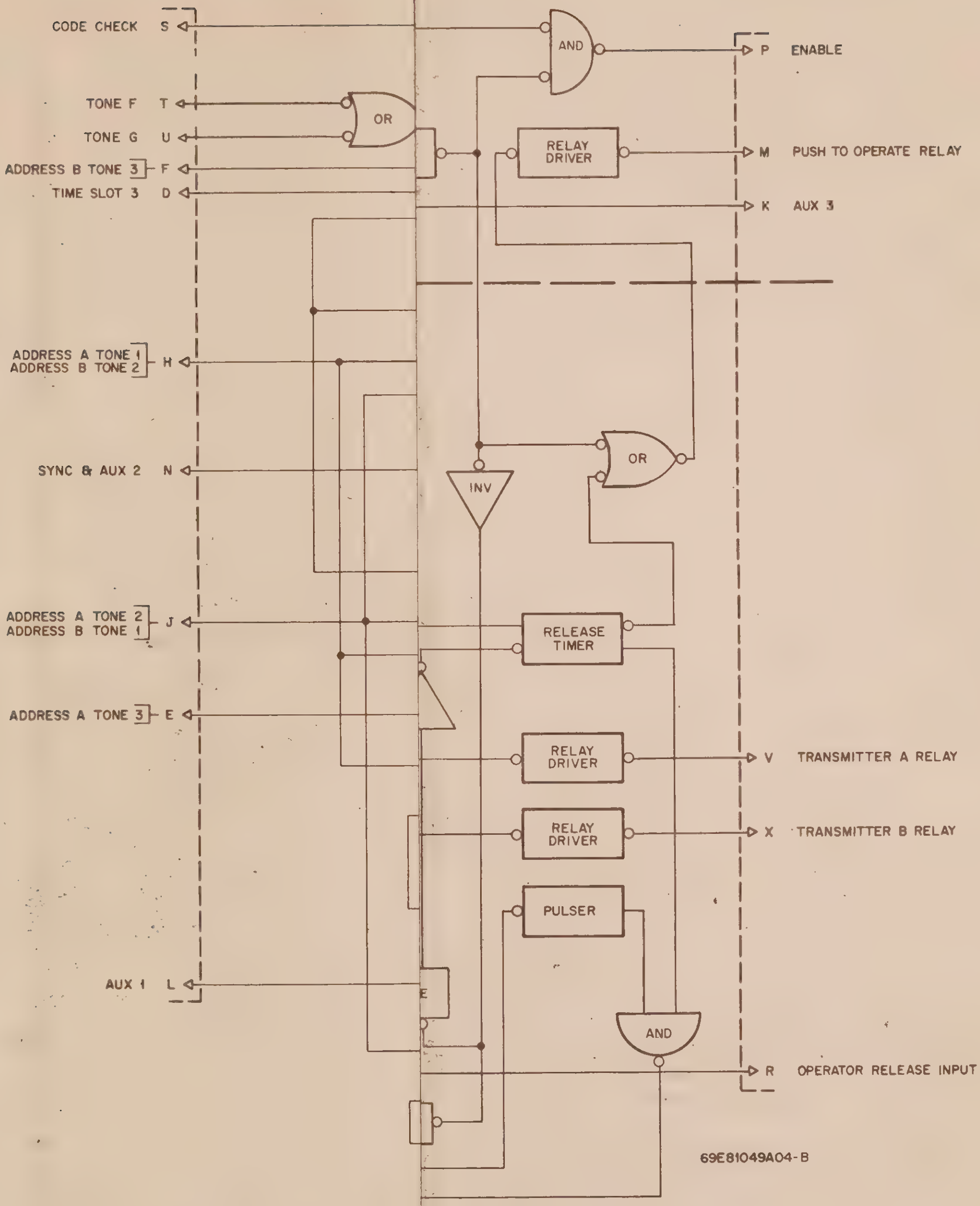

M9412
M9299
BASE
EMITTER
COLLECTOR
TRANSISTOR DETAIL
BOTTOM VIEW
BASE 1
BASE 2
EMITTER
2N2647
EMITTER
BASE 2
BASE 1
UNIJUNCTION TRANSISTOR DETAIL

MODEL TABLE

MODEL	SUFFIX	DESCRIPTION
CLN6167A	3	OPERATOR RELEASE KIT

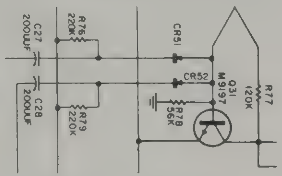
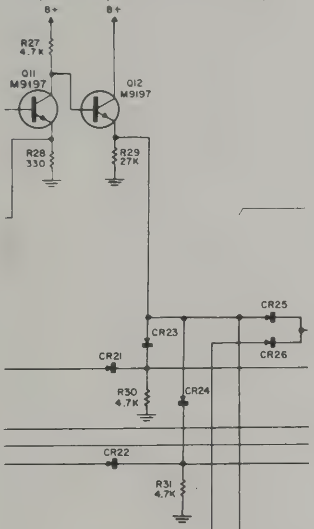
PREVIOUS REVISIONS AND PARTS LIST
SHOWN ON BACK OF THIS DIAGRAM

CLN6167A Operator Release
Schematic Diagram
Motorola No. 63E81049A03-C1
8/28/68-RS


CODE CHECK S
TONE F T
TONE G U
ADDRESS B TONE 3 F
TIME SLOT 3 D
ADDRESS A TONE 1
ADDRESS B TONE 2 H
SYNC & AUX 2 N
ADDRESS A TONE 2
ADDRESS B TONE 1 J
ADDRESS A TONE 3 E
AUX 1 L
AND
OR
RELAY DRIVER
INV
OR
RELEASE TIMER
RELAY DRIVER
RELAY DRIVER
PULSER
AND
E
P ENABLE
M PUSH TO OPERATE RELAY
K AUX 3
V TRANSMITTER A RELAY
X TRANSMITTER B RELAY
R OPERATOR RELEASE INPUT
69E81049A04-B

CLN6167A Operator Release
Functional Diagram
Motorola No. 69E81049A04-B
8/28/68-RS

REVISIONS

DIAG. ISSUE	CHASSIS AND SUFFIX NO.	REF. SYMBOL	CHANGE	LOCATION	REFER TO CIRCUIT BOARD
A	CLN6167A-1	C3, 9, 15, 16, 19, 50	WERE 21D82428B11, .01 uf +70-30%; 100 V	PARTS LIST	OPER RELEASE BOARD PEPD-17649-A
		C25	WAS 21D82537B16, .001 uf ±5%; 100 V		
		C27	WAS 21K840812, 200 uuf ±5%; 500 V	Q31 BASE CIRCUIT	
		C28	REMOVED 21K840812, 200 uuf ±5%; 500 V		
		R79	REMOVED 6S124B06, 220K		
		CR52	REMOVED 48C82392B03 CIRCUIT WAS AS SHOWN BELOW		
			 C27 200UUF R76 220K CR51 CR52 Q31 M9197 R77 120K C28 200UUF R79 220K R78 56K		
		Q12	REMOVED 48R869197	Q11 COLLECTOR	
		R29	REMOVED 6S127886, 27K		
		CR21, 22, 23, 24	REMOVED 48C82392B03		
		R30, 31	REMOVED 6S129669, 4.7K CIRCUIT WAS AS SHOWN BELOW		
			 B+ B+ R27 4.7K Q11 M9197 Q12 M9197 R28 330 R29 27K CR25 CR23 CR21 CR26 R30 4.7K CR24 CR22 R31 4.7K		
		C31, 32	WERE 21K840812, 200 uuf	Q32, Q33 BASE CIRCUIT	
		R16	WERE 6S129668, 10K	Q6 EMITTER	
		R17		Q7 EMITTER	
		R147, 149	ADDED 1 MEG	Q6, Q7 BASE	
		R148, 150	ADDED 1.5K		
		Q57	WAS 48R869242, SM2797	PARTS LIST	
		Q19, 20, 21, 22	WERE 48R869245, M9245		
		R145	WAS 6S129982, 5.6K	Q57 BASE	
		R43	WERE 6S129981, 3.3K	Q19 COLLECTOR	
		R44		Q20 COLLECTOR	
		R41	WERE 6S129526, 33K	Q19 BASE	
		R42		Q20 BASE	
A1		R44	WAS 3.3K	Q20 COLLECTOR	
B	CLN6167A-2	C10	WAS 8D83293B07 (0.5 uf)	Q9 COLLECTOR	
C	CLN6167A-3	C26	WAS 21K840812(200 uuf)	Q30 BASE	
C1	CLN6167A-3		ADDED TRANSISTOR TYPE	DETAIL	

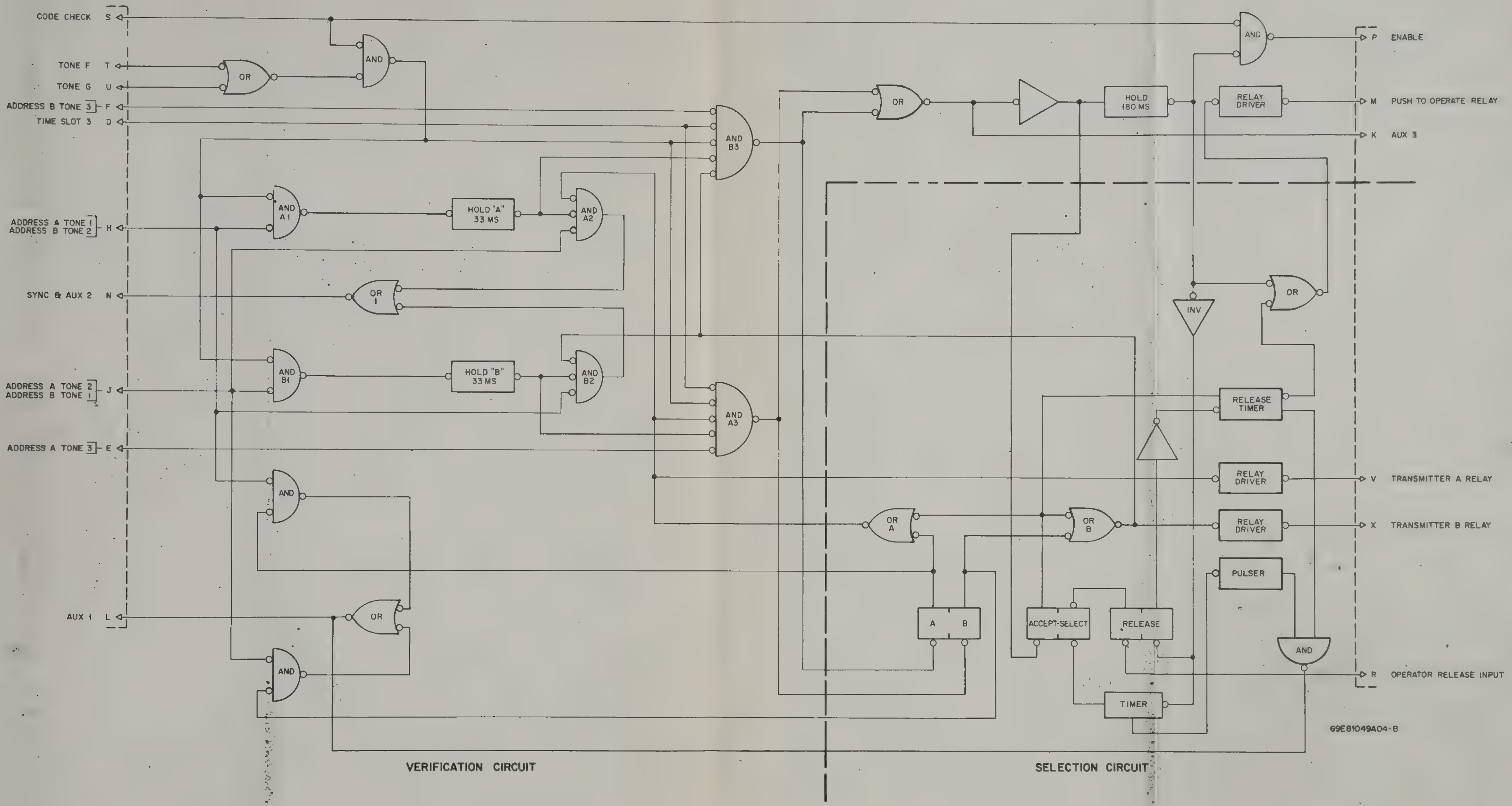
PARTS LIST

CLN6167A Operator Release Kit EPD-17813-B

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
		CAPACITOR, fixed: uf ±10%; 50 v; unl. stated
C1, 7, 17	8D83293B09 or8D82905G10	.015 .015
C2, 8, 18	8D83293B06	.01
C3, 9, 15, 16, 19, 50	21D82428B58	.01 +70-30%; 500 v
C4, 20, 48	8D83293B17	0.12
C5,11,21,25,26, 31,32	21C82187B20	.001; 100 v
C6, 22	21K863291	.0015; ±2%: 500 v
C10	8D82045F01	1; 100 v
C12	8D83293B11 or8D82905G07	0.1 0.1
C13, 14, 43, 45, 46, 52	21C82372C01	0.1 +80-20%; 25 v
C23, 49	8K863305	2; 200 v
C24, 29, 30, 33, 34, 35	23K867384	22; 25 v
C27	21D82428B56	.0047; 200 v
C36, 51	21C82372C05	0.2 +80-20%; 25 v
C37	23D82783B04	100 +150-10%; 25 v
C41	8K864362	1; 200 v
C43	8C82396B04	2 ±20%; 100 v
C44	21C82372C04	.05
C47	8D83293B07	0.5
		SEMICONDUCTOR DEVICE, diode: (SEE NOTE)
CR1 thru 20, 25, 26, 28 thru 31, 33 thru 51, 53 thru 68, 70 thru 75	48C82392B03	silicon
CR32	48D82556C46	silicon; zener type
		CONNECTOR, plug:
P1	1V80765A80	assy; male; 20 cont.; incl. 14A83102B01 INSULATOR, conn 42A83312D01 CLIP, conn (2 req'd); 36A83313D01 KNOB (2 req'd); 22B82637B02 PIN, drive (2 req'd); 3A83275D05 JACKSCREW (male) & 3A83275D06 JACKSCREW (female)
		TRANSISTOR: (SEE NOTE)
Q1 thru 11, 14, 17, 18, 23 thru 38, 43, 47 thru 55, 58	48R869197	N-P-N; type M9197
Q15	48R869146	N-P-N; type M9146
Q16	48R869145	P-N-P; type M9145; stamped SM2718
Q19,20,21,22,57	48R869299	N-P-N; type M9299
Q45	48R869409	N-P-N; type M9409
Q46	48R869385	unijunction, type 2N2647
Q56	48R869412	P-N-P; type M9412
		RESISTOR, fixed: ±5%; 1/4 w; unl. stated
R1, 18, 45, 61, 119, 120	6S129299	68K
R2, 12, 19, 46, 56, 100	6S124B04	180K
R3, 9, 13, 20, 26, 47, 53, 57, 70,74,77,82,87, 90, 93,101, 151	6S131446	120K
R4, 14, 21, 48, 58, 102	6S124A95	82K
R5, 22, 49, 103	6S129805	1K
R6, 15, 23, 50, 104	6S124A60	3K
R7, 24, 51, 63, 128, 134, 139, 142, 143	6S128683	150K
R8, 52	6D82672B52	1.5 meg ±1%; 1/2 w
R10, 16, 17, 27, 54, 125, 126, 127	6S129669	4.7K
R11, 28, 55, 122	6S129806	330
R25	6D82475B62	2.49 meg ±1%; 1/2 w
R35, 36, 71, 80, 81, 88, 89, 94, 129, 132, 152	6S129668	10K
R37, 38, 66, 68	6S131858	270K
R39, 40, 41, 42, 64, 67, 115, 117	6S127886	
R124	6S129526	33K
R43, 44, 145	6S129819	3.9K
R59	6S129818	820
R60	6S129984	680
R62	6S131527	47K
R65	6S129237	6.8K
R69	6S129777	39K
R72, 78, 83, 86	6S128684	56K
R73, 75, 76, 84, 85, 130, 131, 144	6S124B06	220K
R91, 92, 133	6S129473	330K
R95	6D82672B51	886 ±1%; 1/2 w
R96	6D82672B50	499 ±1%; 1/2 w
R97, 98	6S131526	18K
R105, 106	6S124B44	8.2 meg
R116	6S124B32	2.7 meg
R121	6S124B53	20 meg
R123	6S124A19	56
R135, 147, 149	6S129189	1 meg
R136	6S129804	2.2K
R137	6S129707	2.7K
R138	6S124B36	3.9 meg
R140	6S129820	1.8K
R141, 146, 148, 150	6S129681	1.5K

NOTE:

Replacement diodes and transistors must be ordered by Motorola part number only for optimum performance.


CODE CHECK S
TONE F T
TONE G U
ADDRESS B TONE 3 F
TIME SLOT 3 D
ADDRESS A TONE 1
ADDRESS B TONE 2 H
SYNC & AUX 2 N
ADDRESS A TONE 2
ADDRESS B TONE 1 J
ADDRESS A TONE 3 E
AUX 1 L
OR
AND
AND B3
AND A1
HOLD "A" 33 MS
AND A2
OR 1
AND B1
HOLD "B" 33 MS
AND B2
AND A3
AND
OR
AND
OR
HOLD 180 MS
RELAY DRIVER
AND
P ENABLE
M PUSH TO OPERATE RELAY
K AUX 3
INV
OR
RELEASE TIMER
RELAY DRIVER
V TRANSMITTER A RELAY
OR A
OR B
RELAY DRIVER
X TRANSMITTER B RELAY
PULSER
A
B
ACCEPT-SELECT
RELEASE
AND
R OPERATOR RELEASE INPUT
TIMER
69E81049A04-B
VERIFICATION CIRCUIT
SELECTION CIRCUIT

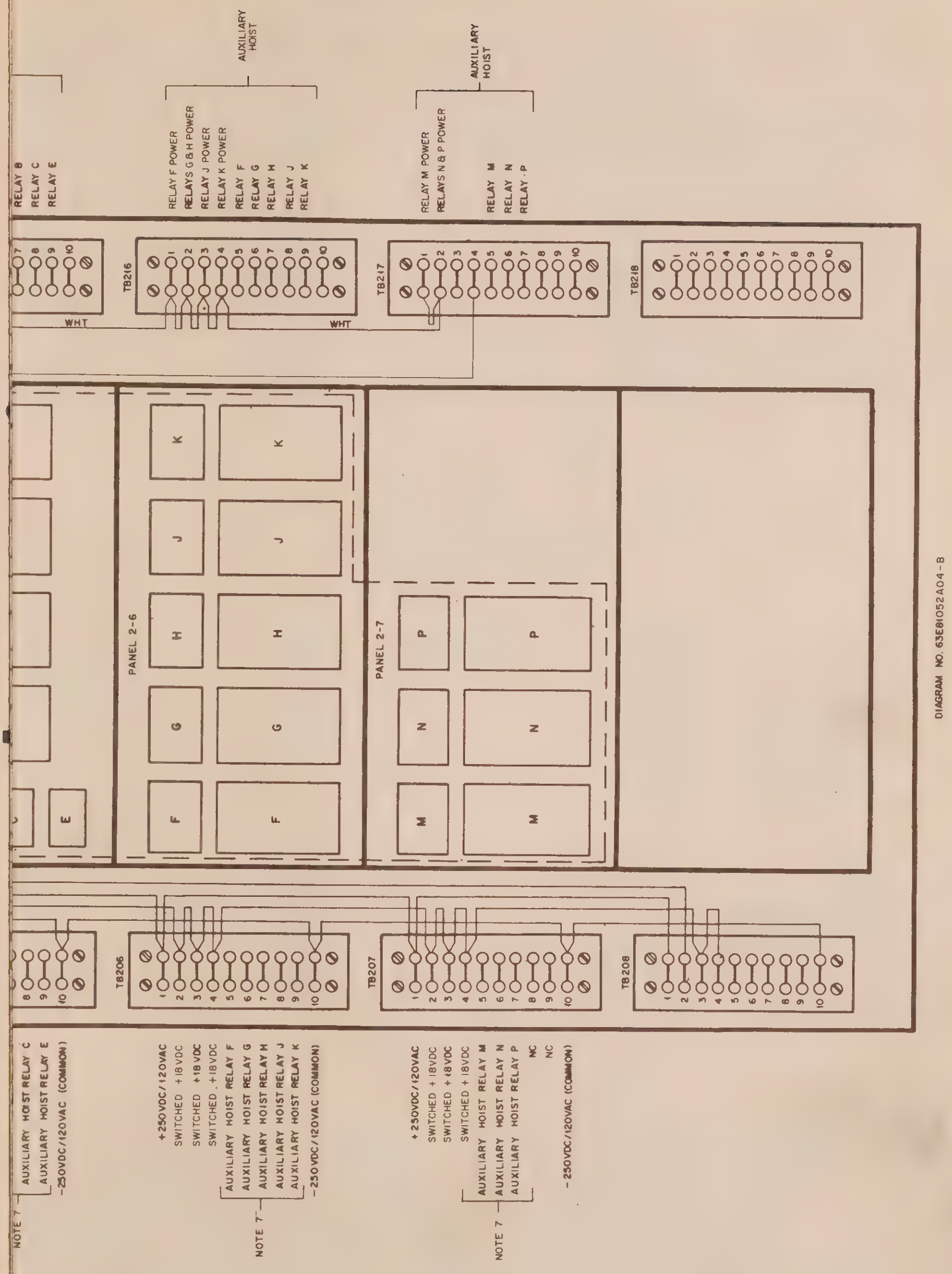
CLN6167A Operator Release
Functional Diagram
Motorola No. 69E81049A04-B
8/28/68-RS

INTERFACE RELAY DIAGRAMS

PAGE

INTERFACE RELAY UNITS

Intercabling and Equipment Location Diagram 11-1
Power Panel Schematic Diagram 11-3
Power Panel 11-5
Magnet and Grapple Panel 11-7
3-Speed Motor Panel 11-9
3-Speed Motor Panel Schematic Diagram 11-11
5-Speed Motor Panel Schematic Diagram 11-12
Motor Select Kit Schematic and Intercabling Diagram 11-13
Auxiliary Function Panel Schematic Diagram 11-15


AUXILIARY HOIST
AUXILIARY HOIST
RELAY B
RELAY C
RELAY E
RELAY F POWER
RELAYS G & H POWER
RELAY J POWER
RELAY K POWER
RELAY F
RELAY G
RELAY H
RELAY J
RELAY K
RELAY M POWER
RELAYS N & P POWER
RELAY M
RELAY N
RELAY P
TB216
TB217
TB218
WHT
WHT
PANEL 2-6
PANEL 2-7
K
J
H
G
F
E
P
N
M
TB206
TB207
TB208
AUXILIARY HOIST RELAY C
AUXILIARY HOIST RELAY E
-250VDC/120VAC (COMMON)
NOTE 7
+250VDC/120VAC
SWITCHED +18VDC
SWITCHED +18VDC
SWITCHED +18VDC
AUXILIARY HOIST RELAY F
AUXILIARY HOIST RELAY G
AUXILIARY HOIST RELAY H
AUXILIARY HOIST RELAY J
AUXILIARY HOIST RELAY K
-250VDC/120VAC (COMMON)
NOTE 7
+250VDC/120VAC
SWITCHED +18VDC
SWITCHED +18VDC
SWITCHED +18VDC
AUXILIARY HOIST RELAY M
AUXILIARY HOIST RELAY N
AUXILIARY HOIST RELAY P
NC
NC
-250VDC/120VAC (COMMON)
NOTE 7
DIAGRAM NO. 63E81052A04-B

PARTS LIST SHOWN ON
BACK OF THIS DIAGRAM

Interface Relay Units Intercabling
And Equipment Location Diagram
Motorola No. 63E81052A04-B
8/28/68-RS

CHART AND
ION CHARTS
E

PAGE

INTERFACE RELAY UNITS

Intercabling and Equipment Location Diagram 11-1
Power Panel Schematic Diagram 11-3
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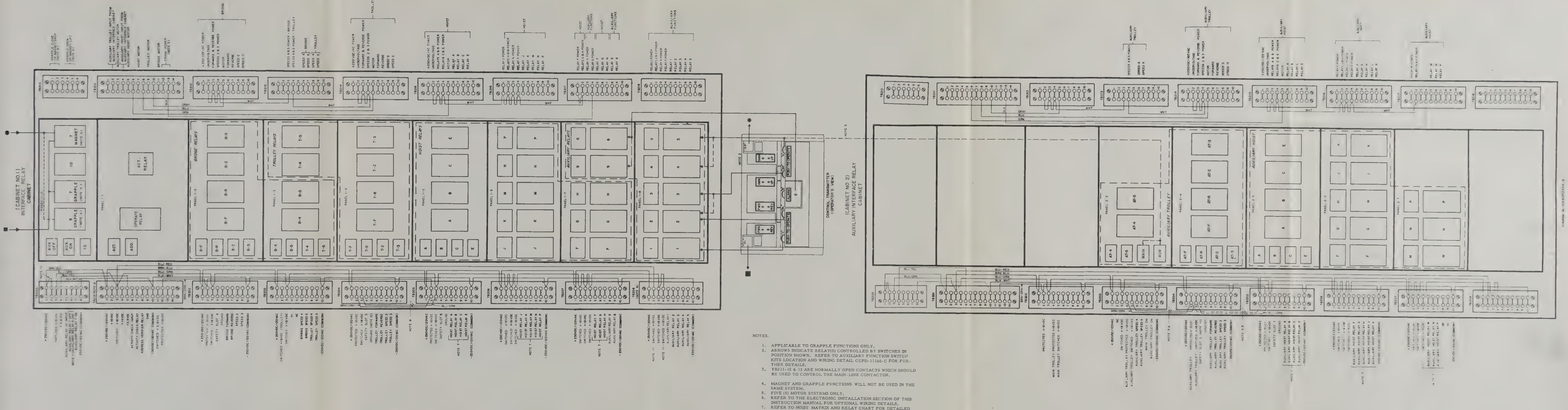
3-Speed Motor Panel Schematic Diagram 11-11
5-Speed Motor Panel Schematic Diagram 11-12
Motor Select Kit Schematic and Intercabling Diagram 11-13
Auxiliary Function Panel Schematic Diagram 11-15


(CABINET NO. 1) INTERFACE RELAY CABINET
BRIDGE RELAYS
TROLLEY RELAYS
HOIST RELAYS
AUXILIARY RELAYS
CONTROL TRANSMITTER (OPERATOR'S VIEW)
(CABINET NO. 2) AUXILIARY INTERFACE RELAY CABINET
AUXILIARY TROLLEY
AUXILIARY HOIST
ACT. RELAY
OPERATE RELAY
MAGNET
GRAPPLE
BRIDGE
TROLLEY
HOIST
AUXILIARY FUNCTIONS

NOTES.

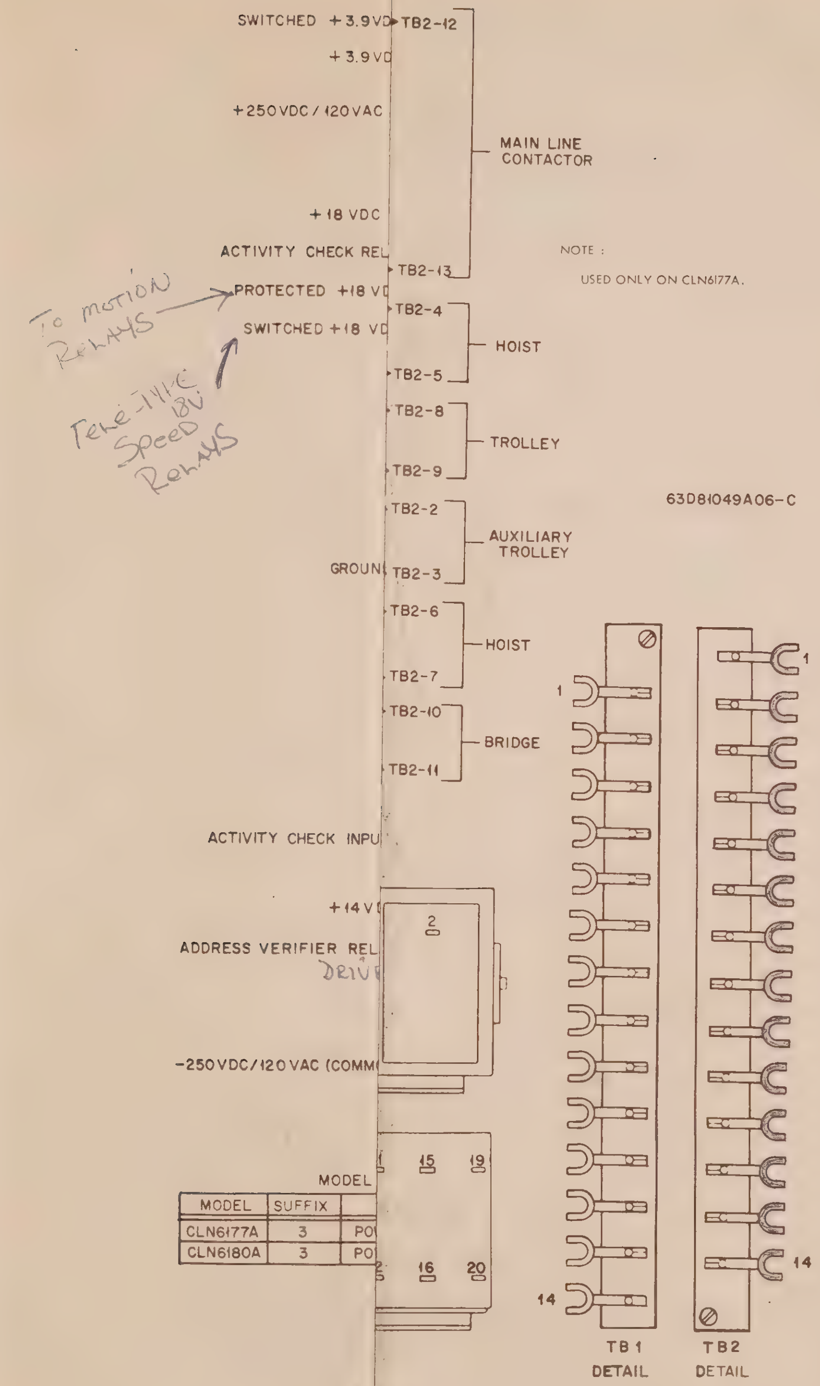
1. APPLICABLE TO GRAPPLE FUNCTIONS ONLY.
2. ARROWS INDICATE RELAY(S) CONTROLLED BY SWITCHES IN POSITION SHOWN. REFER TO AUXILIARY FUNCTION SWITCH KITS LOCATION AND WIRING DETAIL CEPD-11160-C FOR FURTHER DETAILS.
3. TB211-12 & 13 ARE NORMALLY OPEN CONTACTS WHICH SHOULD BE USED TO CONTROL THE MAIN-LINE CONTACTOR.

4. MAGNET AND GRAPPLE FUNCTIONS WILL NOT BE USED IN THE SAME SYSTEM.
5. FIVE (5) MOTOR SYSTEMS ONLY.
6. REFER TO THE ELECTRONIC INSTALLATION SECTION OF THIS INSTRUCTION MANUAL FOR OPTIONAL WIRING DETAILS.
7. REFER TO HOIST MATRIX AND RELAY CHART FOR DETAILED INPUT INFORMATION.
8. TWO-WIRE JUMPER IN CABINET NO. 1 IS REMOVED IN 5-MOTOR SYSTEMS.
9. TWO-WIRE JUMPER CONNECTIONS FOR CABINET NO. 2:
   A. SOLID-LINE CONNECTIONS FOR 5-MOTOR SYSTEMS.
   B. DASHED-LINE CONNECTIONS FOR 4-MOTOR SYSTEMS.
10. FOR 3- AND 4- MOTOR SYSTEMS, TB204-5 ON PANEL 1-4 CONNECTS TO GROUND. FOR 5-MOTOR SYSTEMS THE CONNECTION IS TO TB204-4 ON PANEL 2-4.
11. RELAYS 2 & 3 OR 4 & 5 MAY, IN SOME SYSTEMS, BE DRIVEN BY ELECTRONICALLY LATCHED RELAY DRIVER CIRCUITS AND REQUIRE THAT A RELAY BE ENERGIZED CONTINUOUSLY. IN SUCH SYSTEMS, +18 V DC IS SUPPLIED TO THE RELAYS (NOT SWITCHED +18 V DC). IT IS USUALLY SUPPLIED THROUGH THE BLU-RED WIRE FROM TB201-2.
12. FOR MAGNET FUNCTIONS THE JUMPER CONNECTED TO TB200-2 IS REMOVED.

COMPLEMENT LOCATION CHART AND
LOCATION AND TERMINATION CHARTS
ON REVERSE SIDE

PARTS LIST SHOWN ON
BACK OF THIS DIAGRAM

Interface Relay Units Intercabling
And Equipment Location Diagram
Motorola No. 63E81052A04 B
8/28/68-RS


SWITCHED +3.9VD
TB2-12
+3.9VD
+250VDC/120VAC
MAIN LINE CONTACTOR
+18 VDC
ACTIVITY CHECK REL
TB2-13
NOTE :
USED ONLY ON CLN6177A.
To motion RELAYS
PROTECTED +18 VD
SWITCHED +18 VD
Tele-TYPE 18V Speed RELAYS
TB2-4
HOIST
TB2-5
TB2-8
TROLLEY
TB2-9
63D81049A06-C
TB2-2
AUXILIARY TROLLEY
GROUN
TB2-3
TB2-6
HOIST
TB2-7
TB2-10
BRIDGE
TB2-11
ACTIVITY CHECK INPU
+14 V
2
ADDRESS VERIFIER REL
DRIVE
-250VDC/120VAC (COMM
MODEL
15
19
16
20
1
14
1
14
TB 1 DETAIL
TB 2 DETAIL

MODEL	SUFFIX	
CLN6177A	3	PO
CLN6180A	3	PO

PREVIOUS REVISIONS AND PARTS LIST
SHOWN ON BACK OF THIS DIAGRAM

CLN6177A (DC) and CLN6180A (AC)
Power Panel 3motor
Schematic Diagram
Motorola No. 63D81049A06-C
1/8/70-RS

DC AUXILIARY FUNCTION RELAY KITS LOCATION AND TERMINATION CHART

RELAY KIT MODEL	DESCRIPTION	RELAYS	RELAY LOCATION		OUTPUT TERMINATION CABINET 1	CONTROL XMTR AUX. FUNCTION SWITCH KIT
			PANEL	POSITION		
CLN1026AA	LIGHTS ON-OFF	CLN6109A	1-8	5	TB218-9, 4	CLN1006AA
CLN1027AA	BRAKE	CLN6109A	1-8	5	TB218-9, 4	CLN1007AA
CLN1027AB	BRAKE	CLN6109A	1-8	3	TB218-7, 2	CLN1007AB
CLN1027AC	BRAKE	CLN6109A	1-8	1	TB218-5, 1	CLN1007AC
CLN1028AA	OPERATOR A	CLN6109A	1-8	5	TB218-9, 4	CLN1008AA
	OPERATOR B	CLN6109A	1-8	4	TB218-8, 3	
CLN1028AB	OPERATOR A	CLN6109A	1-8	3	TB218-7, 2	CLN1008AB
	OPERATOR B	CLN6109A	1-8	2	TB218-6, 2	
CLN1029AB	HOOK ROTATE RIGHT	CLN6109A	1-8	3	TB218-7, 2	CLN1009AB
	HOOK ROTATE LEFT	CLN6109A	1-8	2	TB218-6, 2	
CLN1030AA	HOLD	CLN6109A	1-8	5	TB218-9, 4	CLN1010AA
CLN1033AE	ALARM	CLN6109A	1-7	9	TB217-8, 3	CLN1013AE
CLN1035AD	MAGNET LIFT	CLN6111A	1-0	7	TB210-1, 2	CLN1011AD
	MAGNET DROP	CLN6111A	1-0	7	TB210-4, 5	
CLN1036AD	GRAPPLE CLOSE	CLN6109A	1-0	7	TB210-1, 2	CLN1012AD
	GRAPPLE OPEN	CLN6109A	1-0	8	TB210-4, 5	
CLN1037AE	ALARM/RESET	CLN6175A	1-7	6, 9	TB217-9, 4, 8, 3	CLN1017AE
CLN1038AE	RESET	CLN6109A	1-7	6	TB217-9, 4	CLN1018AE

AC AUXILIARY FUNCTION RELAY KITS LOCATION AND TERMINATION CHART

RELAY KIT MODEL	DESCRIPTION	RELAYS	RELAY LOCATION		OUTPUT TERMINATION CABINET 1	CONTROL XMTR AUX. FUNCTION SWITCH KIT
			PANEL	POSITION		
CLN1046AA	LIGHTS ON-OFF	CLN6103A	1-8	5	TB218-9, 4	CLN1006AA
CLN1047AA	BRAKE	CLN6103A	1-8	5	TB218-9, 4	CLN1007AA
CLN1047AB	BRAKE	CLN6103A	1-8	3	TB218-7, 2	CLN1007AB
CLN1047AC	BRAKE	CLN6103A	1-8	1	TB218-5, 1	CLN1007AC
CLN1048AA	OPERATOR A	CLN6103A	1-8	5	TB218-9, 4	CLN1008AA
	OPERATOR B	CLN6103A	1-8	4	TB218-8, 3	
CLN1048AB	OPERATOR A	CLN6103A	1-8	3	TB218-7, 2	CLN1008AB
	OPERATOR B	CLN6103A	1-8	2	TB218-6, 2	
CLN1049AB	HOOK ROTATE RIGHT	CLN6103A	1-8	3	TB218-7, 2	CLN1009AB
	HOOK ROTATE LEFT	CLN6103A	1-8	2	TB218-6, 2	
CLN1050AA	HOLD	CLN6103A	1-8	5	TB218-9, 4	CLN1010AA
CLN1053AE	ALARM	CLN6103A	1-7	9	TB217-8, 3	CLN1013AE
CLN1055AD	MAGNET LIFT	CLN6105A	1-0	7	TB210-1, 2	CLN1011AD
	MAGNET DROP	CLN6105A	1-0	7	TB210-4, 5	
CLN1056AD	GRAPPLE CLOSE	CLN6103A	1-0	7	TB210-1, 2	CLN1012AD
	GRAPPLE OPEN	CLN6103A	1-0	8	TB210-4, 5	
CLN1057AE	ALARM/RESET	CLN6176A	1-7	6, 9	TB217-9, 4, 8, 3	CLN1017AE
CLN1058AE	RESET	CLN6103A	1-7	6	TB217-9, 4	CLN1018AE

INTERFACE RELAY UNITS PANEL COMPLEMENT LOCATION CHART
(REFER TO MODEL CHART FOR MODEL NOMENCLATURES)

MODEL	CABINET	PANEL LOCATION								
		0	1	2	3	4	5	6	7	8
C1146A	1	CLN6169A*	CLN6177A	CLN6106A	-	CLN6106A	CLN6106A*	CLN6168A*	CLN6168A	CLN6168A
C1147A	1	CLN6169A*	CLN6177A	CLN6106A	CLN6107A	CLN6106A	CLN6106A*	CLN6168A*	CLN6168A	CLN6168A
C1148A	2	-	-	-	-	-	CLN6106A	CLN6168A	CLN6168A*	-
C1149A	2	-	-	-	CLN6121B	CLN6106A	CLN6106A	CLN6168A	CLN6168A*	-
C1160A	2	-	-	-	CLN6121B	CLN6106A	CLN6106A	CLN6168A	CLN6168A*	-
C1156A	1	CLN6169A*	CLN6180A	CLN6100A	-	CLN6100A	CLN6100A*	CLN6168A*	CLN6168A	CLN6168A
C1157A	1	CLN6169A*	CLN6180A	CLN6100A	CLN6101A	CLN6100A	CLN6100A*	CLN6168A*	CLN6168A	CLN6168A
C1158A	2	-	-	-	-	-	CLN6100A	CLN6168A	CLN6168A*	-
C1159A	2	-	-	-	CLN6121B	CLN6100A	CLN6100A	CLN6168A	CLN6168A*	-
C1185A	2	-	-	-	CLN6121B	CLN6100A	CLN6100A	CLN6168A	CLN6168A*	-

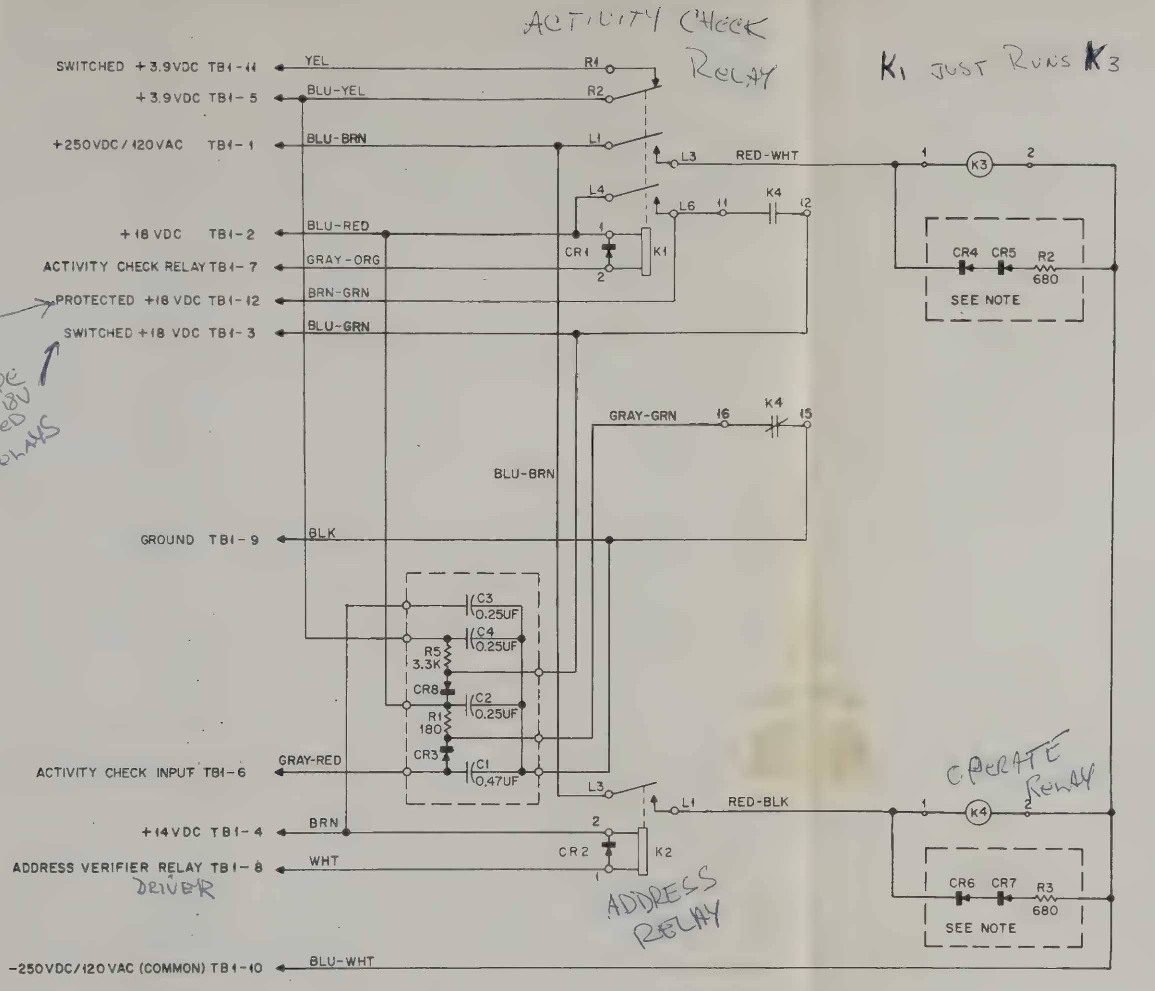
*USE DEPENDENT UPON CRANE REQUIREMENTS

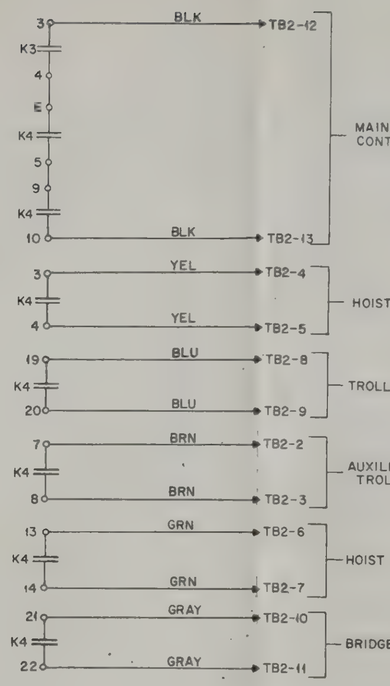
EPD-17652-A

PARTS LIST

CHN6013A Cabinet Kit EPD-12298-A

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
		TERMINAL BOARD
TB200	31K816278	8 dual screw terminals with 7/16" spacing; does not incl. 13C82343C03 MARKER, terminal identification
TB201	31K832894	14 dual screw terminals with 7/16" spacing; does not incl. 13C82343C05 MARKER, terminal identification
TB202 thru 208	31K846795	10 dual screw terminals with 7/16" spacing; does not incl. 13C82343C06 MARKER, terminal identification
TB210	31K832829	6 dual screw terminals with 9/16" spacing; does not incl. 13B82014G05 MARKER, terminal identification
TB211	31K51744	14 dual screw terminals with 9/16" spacing; does not incl. 13B82014G04 MARKER, terminal identification
TB212 thru 218	31K80340	10 dual screw terminals with 9/16" spacing; does not incl. 13B82014G03 MARKER, terminal identification


ACTIVITY CHECK Relay
K1 JUST RUNS K3
SWITCHED +3.9VDC TB1-11
+3.9VDC TB1-5
+250VDC/120VAC TB1-1
+18 VDC TB1-2
ACTIVITY CHECK RELAY TB1-7
PROTECTED +18 VDC TB1-12
SWITCHED +18 VDC TB1-3
To motion Relays
Tele-Type 18V Speed Relays
GROUND TB1-9
ACTIVITY CHECK INPUT TB1-6
+14VDC TB1-4
ADDRESS VERIFIER RELAY TB1-8
DRIVER
-250VDC/120VAC (COMMON) TB1-10
YEL
BLU-YEL
BLU-BRN
BLU-RED
GRAY-ORG
BRN-GRN
BLU-GRN
BLK
GRAY-RED
BRN
WHT
BLU-WHT
GRAY-GRN
RED-WHT
RED-BLK
R1
R2
L1
L3
L4
L6
K1
K2
K3
K4
CR1
CR2
CR3
CR4
CR5
CR6
CR7
CR8
R2 680
R3 680
C3 0.25UF
C4 0.25UF
R5 3.3K
C2 0.25UF
R1 180
C1 0.47UF
SEE NOTE
SEE NOTE
OPERATE Relay
ADDRESS RELAY

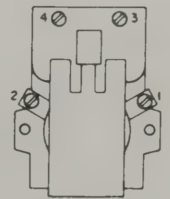

K3
K4
BLK
TB2-12
BLK
TB2-13
MAIN LINE CONTACTOR
YEL
TB2-4
YEL
TB2-5
HOIST
BLU
TB2-8
BLU
TB2-9
TROLLEY
BRN
TB2-2
BRN
TB2-3
AUXILIARY TROLLEY
GRN
TB2-6
GRN
TB2-7
HOIST
GRAY
TB2-10
GRAY
TB2-11
BRIDGE

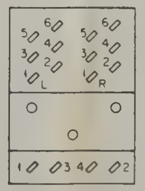
NOTE
USED ONLY ON CLN6177A

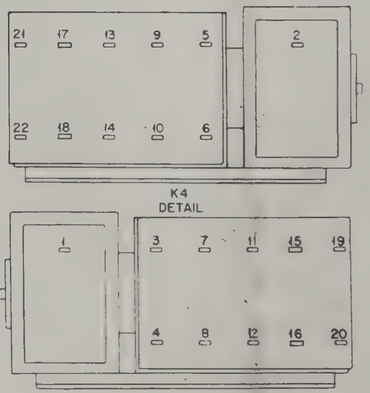
63D81049A06-C

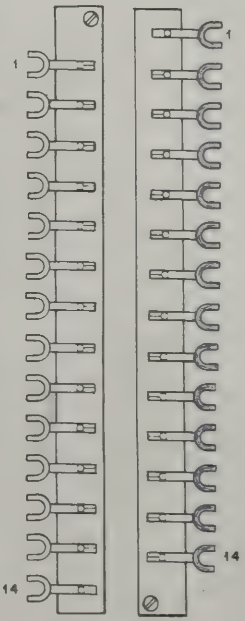
MODEL TABLE

MODEL	SUFFIX	DESCRIPTION
CLN6177A	3	POWER PANEL (DC) NEMA6
CLN6180A	3	POWER PANEL (AC) NEMA6


K3
DETAIL


K1, K2
SOCKET DETAIL


K4
DETAIL

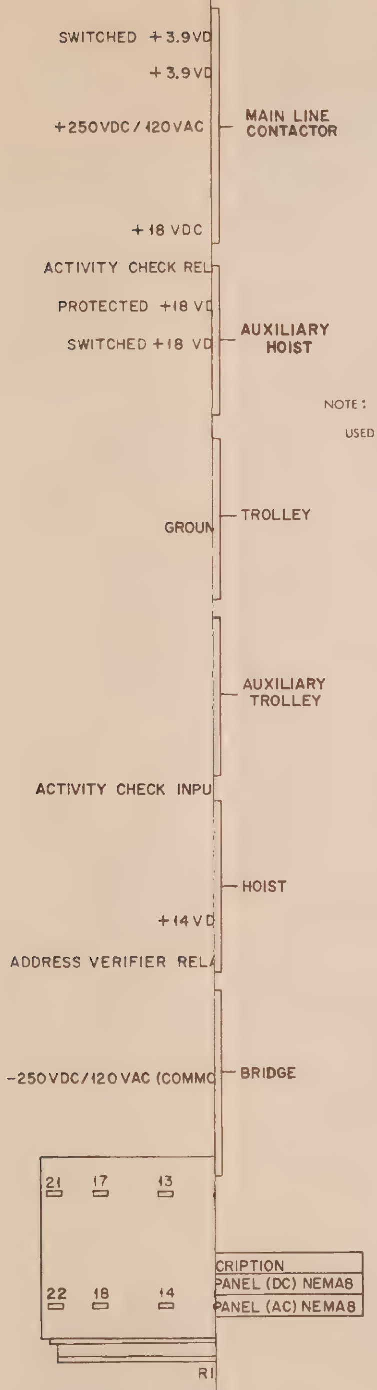

TB1
DETAIL

TB2
DETAIL

K2 OPERATES K4

PREVIOUS REVISIONS AND PARTS LIST
SHOWN ON BACK OF THIS DIAGRAM

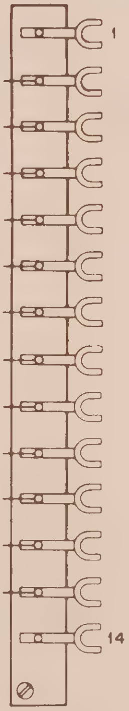
CLN6177A (DC) and CLN6180A (AC)
Power Panel 3motor
Schematic Diagram
Motorola No. 63D81049A06-C
1/8/70-RS


SWITCHED +3.9VD
+3.9VD
+250VDC/120VAC
MAIN LINE CONTACTOR
+18 VDC
ACTIVITY CHECK REL
PROTECTED +18 VD
SWITCHED +18 VD
AUXILIARY HOIST
GROUN
TROLLEY
AUXILIARY TROLLEY
ACTIVITY CHECK INPU
HOIST
+14VD
ADDRESS VERIFIER REL
-250VDC/120VAC (COMMO
BRIDGE
21
17
13
22
18
14
CRIPTION
PANEL (DC) NEMA8
PANEL (AC) NEMA8
R1

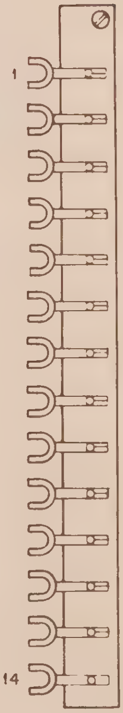
NOTE:

USED ONLY ON CLN6178A.

63D81049A07-C



TB2 DETAIL



TB1 DETAIL

PREVIOUS REVISIONS AND PARTS LIST
SHOWN ON BACK OF THIS DIAGRAM

CLN6178A (DC) and CLN6181A (AC)
Power Panel 4+5 motor
Schematic Diagram
Motorola No. 63D81049A07-C
1/8/70-RS

REVISIONS

DIAG. ISSUE	CHASSIS AND SUFFIX NO.	REF. SYMBOL	CHANGE	LOCATION
A	CLN6177A-1 CLN6180A-1	C1	ADDED	SCHEMATIC DIAGRAM
B	CLN6177A-2 CLN6180A-2	C2, 3, 4 CR8 R4		
B1	CLN6177A-2 CLN6180A-2	TB1	REVERSED DETAIL	
C	CLN6177A-3 CLN6180A-3	C2, 3, 4	WERE 8C82095G12, 0. 15 uf	SCHEMATIC DIAGRAM

PARTS LIST

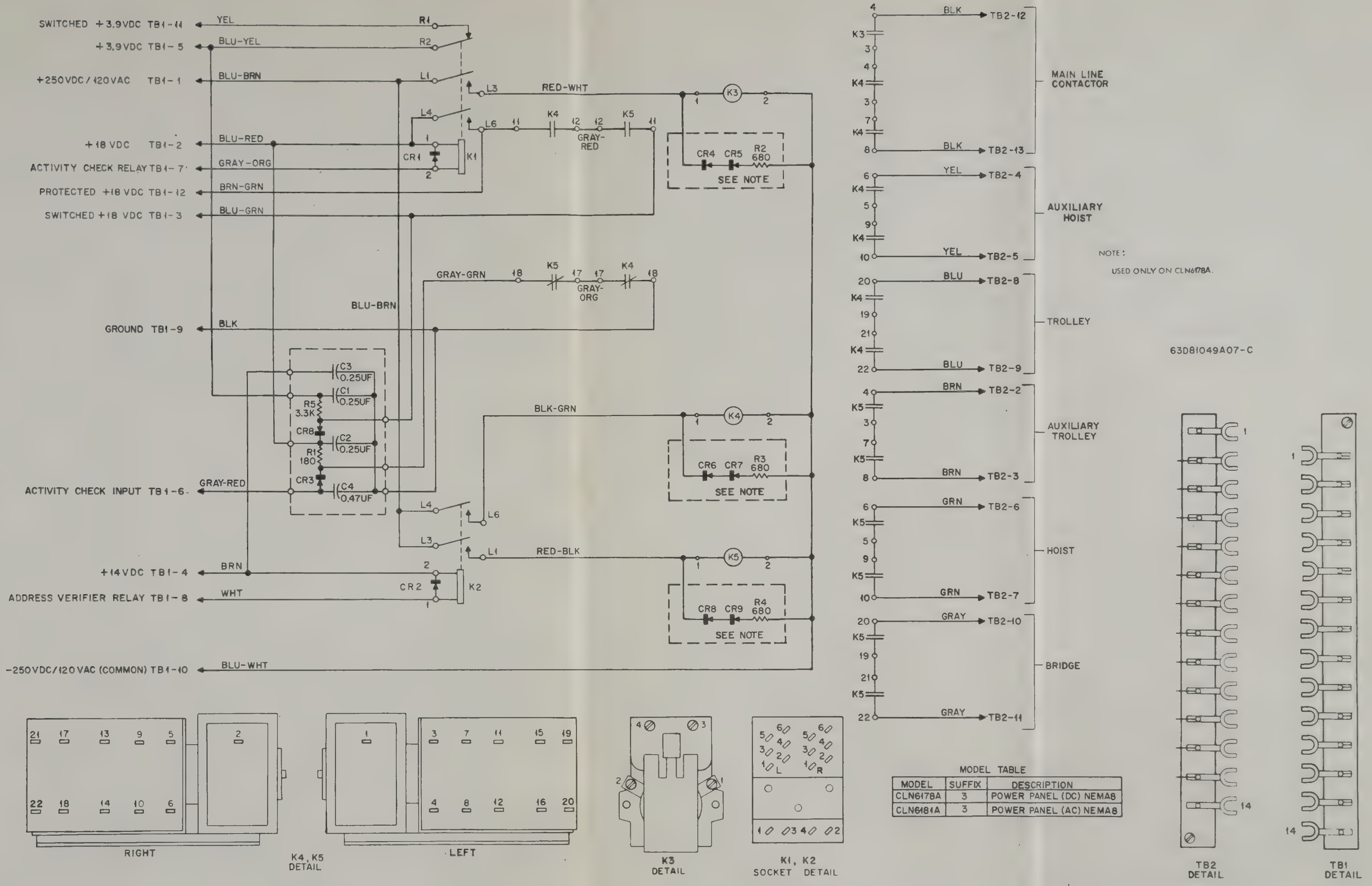
CLN6177A Power Panel (DC)
CLN6180A Power Panel (AC)

EPD-17833-B

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
		CAPACITOR, fixed:
C1	8K863994	0.47 uf ±10%; 100 v
C2, 3, 4	8K864440	0.25
		SEMICONDUCTOR DEVICE, diode: (SEE NOTE)
CR1, 2, 3, 8	48C82392B03	silicon
CR4, 5, 6, 7	48C82466H17	silicon (dc model)
		RELAY, armature:
K1	80D83379B04	telephone type; 2 stack; left stack; 2 form "A"; right stack; 1 form "B"; coil res. 350 ohms ±10%; does not incl 15A83377B01 COVER
K2	80D83379B01	telephone type; 1 form "A"; coil res. 500 ohms ±10%; does not incl 15A83377B01 COVER
K3	80C83261B03	120 v ac; 60 cps; 1 form "A"; coil res. 200 ohms ±10%; (ac model)
	or80C83261B01	230 v dc; 1 form "A"; coil res. 1200 ohms ±10% (dc model)
K4	80C83262B05	120 v ac; 60 cps; 8 form "A"; 2 form "B"; coil res. 77 ohms ±20% (ac model)
	or80C83260B05	230 v dc; 8 form "A"; 2 form "B"; coil res. 4680 ohms ±20% (dc model)
		RESISTOR, fixed:
R1	17C82291B05	180 ±10%; 5 w
R2, 3	6S5651	680 ±5%; 1/2 w (dc model)
R4	6S129981	3.3K +5%; 1/4 w
		SOCKET, relay:
XK1, 2	9A83376B01	female; 16 cont

NOTE:

Replacement diodes must be ordered by Motorola part number only for optimum performance.


SWITCHED +3.9VDC TB1-11
+3.9VDC TB1-5
+250VDC/120VAC TB1-1
+18 VDC TB1-2
ACTIVITY CHECK RELAY TB1-7
PROTECTED +18 VDC TB1-12
SWITCHED +18 VDC TB1-3
GROUND TB1-9
ACTIVITY CHECK INPUT TB1-6
+14VDC TB1-4
ADDRESS VERIFIER RELAY TB1-8
-250VDC/120VAC (COMMON) TB1-10
YEL
BLU-YEL
BLU-BRN
BLU-RED
GRAY-ORG
BRN-GRN
BLU-GRN
GRAY-GRN
BLK
GRAY-RED
BRN
WHT
BLU-WHT
RED-WHT
BLK-GRN
RED-BLK
GRAY-RED
GRAY-ORG
R1
R2
L1
L3
L4
L6
K1
K2
K3
K4
K5
CR1
CR2
C3 0.25UF
C1 0.25UF
R5 3.3K
CR8
C2 0.25UF
R1 180
CR3
C4 0.47UF
CR4 CR5 R2 680
SEE NOTE
CR6 CR7 R3 680
SEE NOTE
CR8 CR9 R4 680
SEE NOTE
TB2-12
TB2-13
MAIN LINE CONTACTOR
TB2-4
TB2-5
AUXILIARY HOIST
TB2-8
TB2-9
TROLLEY
TB2-2
TB2-3
AUXILIARY TROLLEY
TB2-6
TB2-7
HOIST
TB2-10
TB2-11
BRIDGE
BLK
YEL
BLU
BRN
GRN
GRAY
63D81049A07-C
RIGHT
LEFT
K4, K5 DETAIL
K3 DETAIL
K1, K2 SOCKET DETAIL
TB2 DETAIL
TB1 DETAIL

NOTE:
USED ONLY ON CLN6178A.

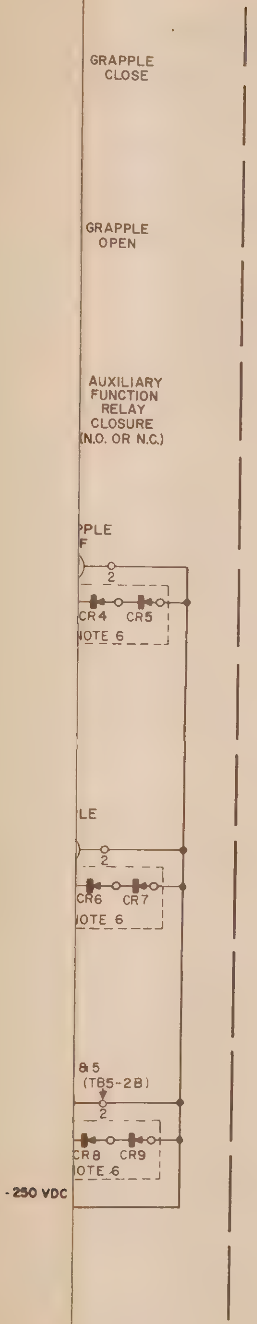
MODEL TABLE

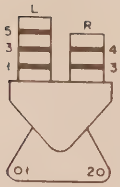
MODEL	SUFFIX	DESCRIPTION
CLN6178A	3	POWER PANEL (DC) NEMA8
CLN6181A	3	POWER PANEL (AC) NEMA8

K2 OPERATES K4+K5

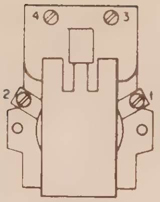
PREVIOUS REVISIONS AND PARTS LIST SHOWN ON BACK OF THIS DIAGRAM

CLN6178A (DC) and CLN6181A (AC)
Power Panel 4+5 motor
Schematic Diagram
Motorola No. 63D81049A07-C
1/8/70-RS

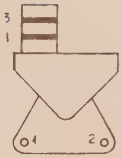

GRAPPLE CLOSE
GRAPPLE OPEN
AUXILIARY FUNCTION RELAY CLOSURE (N.O. OR N.C.)
PPLE
F
2
CR4
CR5
OTE 6
LE
2
CR6
CR7
OTE 6
& 5
(TB5-2B)
2
CR8
CR9
OTE 6
-250 VDC



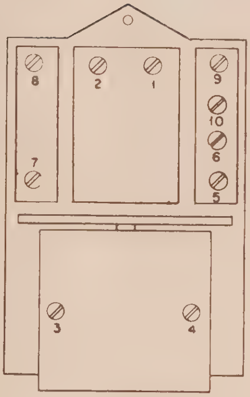
K1M, K2M DETAIL



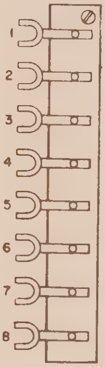
K5, K6, K7 DETAIL



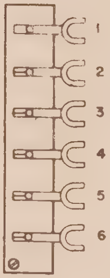
K1G, K2G, K3 DETAIL


8
2
1
9
10
6
7
5
3
4

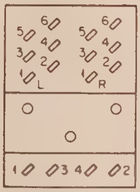
K4 DETAIL



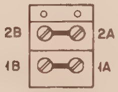
TB1 DETAIL



TB2 DETAIL


6
5
4
3
2
1
L
6
5
4
3
2
1
R
1
3
4
2

K1, K2, K3 SOCKET DETAIL



TB3, TB4, TB5, TB6 DETAIL

NOTES:

1. USED ONLY ON CLN1035AD.
2. K3 AND K5 IS AN AUXILIARY FUNCTION RELAY KIT NORMALLY NOT INCLUDED ON THIS PANEL. DASHED LINES SHOW NON-EXISTENT WIRES.
3. FOR PROPER MAGNET CIRCUIT OPERATION, A JUMPER MUST BE REMOVED FROM TB200-1 TO TB200-2 IN THE INTERFACE RELAY UNIT CABINET.
4. K4 IS A MECHANICALLY LATCHING RELAY. K4A IS THE LOCKUP COIL AND K4B IS THE RELEASE COIL. ONCE K4A IS ACTIVATED, THE CONTACT ARMS REMAIN PULLED IN UNTIL K4B IS ACTIVATED TO RELEASE THE CONTACT ARM.
5. WHEN K5 IS NOT USED, THE LOOSE WIRES ARE CONNECTED TO A "DUMMY" TERMINAL BOARD TB5 (TERMINALS SHOWN IN PARENTHESES).
6. USED ONLY ON CLN1036AD.

MODEL TABLE

MODEL	SUFFIX	DESCRIPTION
CLN6169A		MAGNET AND GRAPPLE PANEL
CLN1035AD		MAGNET FUNCTION RELAY KIT (DC)
CLN1055AD		MAGNET FUNCTION RELAY KIT (AC)
CLN1036AD		GRAPPLE FUNCTION RELAY KIT (DC)
CLN1056AD		GRAPPLE FUNCTION RELAY KIT (AC)

PREVIOUS REVISIONS AND PARTS LIST
SHOWN ON BACK OF THIS DIAGRAM

CLN6169A Magnet and Grapple Panel
Schematic Diagram
Motorola No. 63E81049A08-O1
8/28/68-RS

REVISIONS

DIAG. ISSUE	CHASSIS AND SUFFIX NO.	REF. SYMBOL	CHANGE	LOCATION
A	CLN6178A-1 CLN6181A-1	C1	ADDED	SCHEMATIC DIAGRAM
B	CLN6178A-2 CLN6181A-2	C2, 3, 4 R5		
B1	CLN6178A-2 CLN6181A-2	TB1	REVERSED DETAIL	
C	C1N6178A-3 C1N6181A-3	C2, 3, 4	WERE 8C82095G12, 0. 15 uf	SCHEMATIC DIAGRAM

PARTS LIST

CLN6178A Power Panel (DC)
CLN6181A Power Panel (AC)

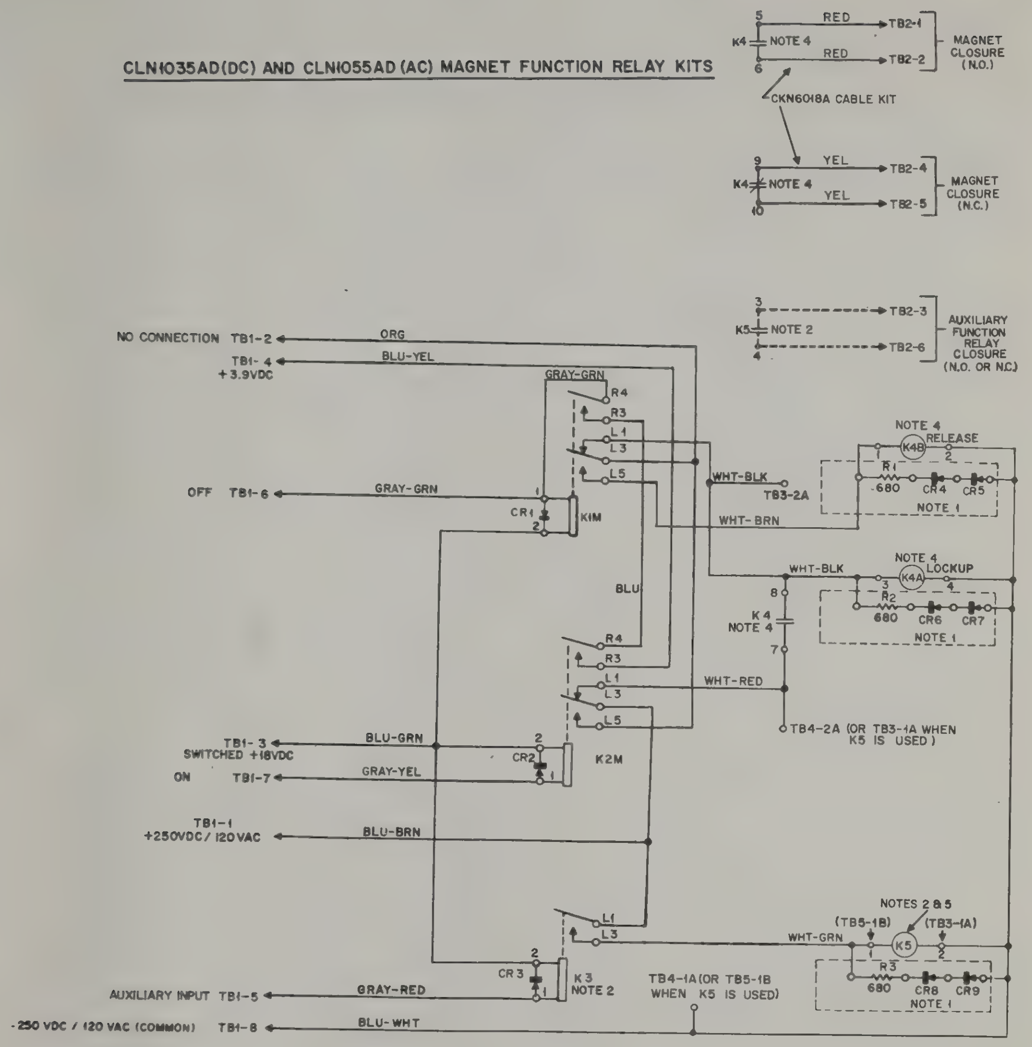
EPD-17832-A

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
		CAPACITOR, fixed:
C1	8K863994	0.47 uf ±10%; 100 v
C2, 3, 4	8K864440	0.25 uf ±10%; 200 v
		SEMICONDUCTOR DEVICE, diode: (SEE NOTE)
CR1, 2, 3	48C82392B03	silicon
CR4, 5, 6, 7	48C82466H17	silicon (dc model only)
		RELAY, armature:
K1, 2	80D83379B04	telephone type; 2 stack; left stack; 2 form "A"; right stack 1 form "B"; coil res. 350 ohms ±10%; does not incl 15A83377B01 COVER
K3	80C83261B03	120 v ac, 60 cps; 1 form "A"; coil res. 200 ohms ±10%; (ac model)
	or80C83261B01	230 v dc; 1 form "A"; coil res. 12000 ±10%; (dc model)
K4, 5	80C83262B05	120 v ac; 60 cps; 8 form "A"; 2 form "B"; coil res. 77 ohms ±20% (ac model)
	or80C83260B05	230 v dc; 8 form "A"; 2 form "B" coil res. 4680 ohms ±20% (dc model)
		RESISTOR, fixed:
R1	17C82291B05	180 ±10%; 5 w
R2, 3, 4	6S5651	680 ±5%; 1/2 w (dc model)
R5	6S129981	3.3K ±5%; 1/4 w
		SOCKET, relay:
XK1, 2	9A83376B01	female; 16 cont

NOTE:

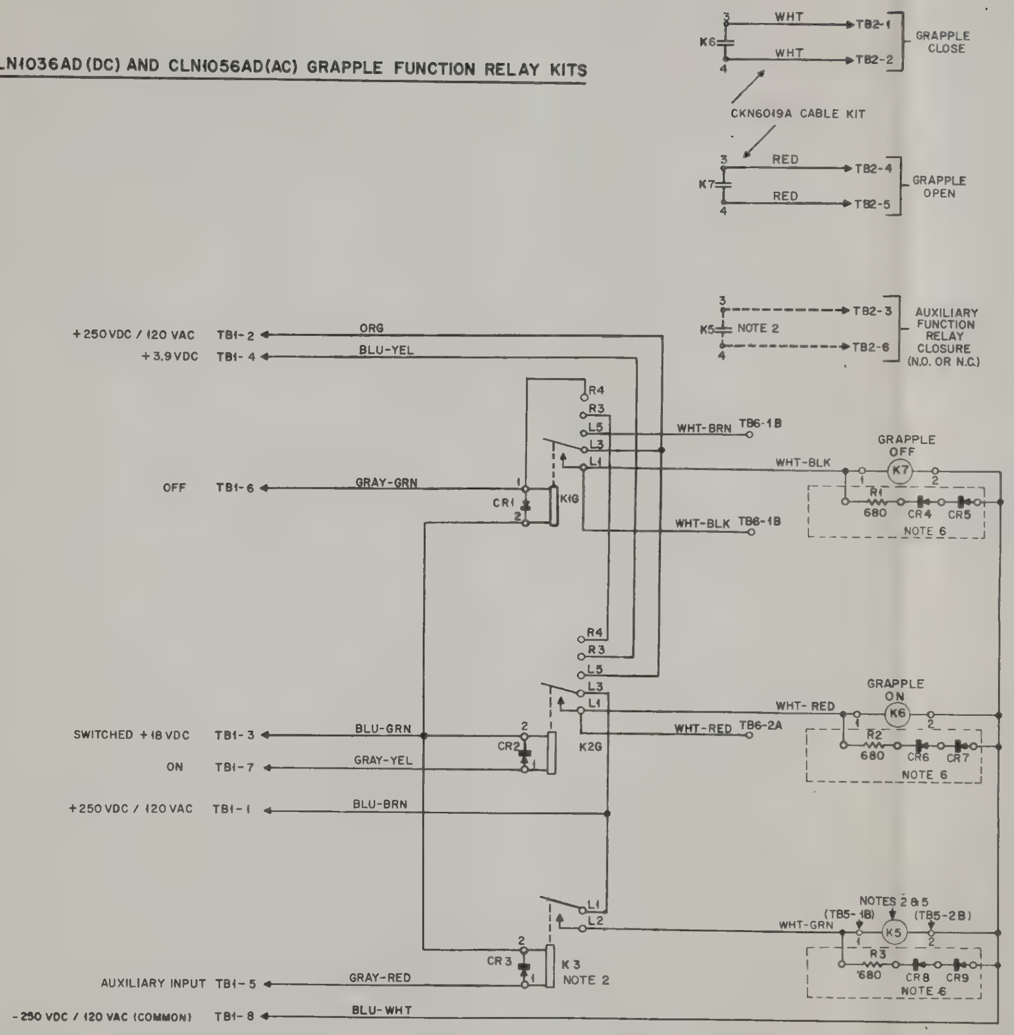
Replacement diodes must be ordered by Motorola part number only for optimum performance.

CLN1035AD(DC) AND CLN1055AD(AC) MAGNET FUNCTION RELAY KITS



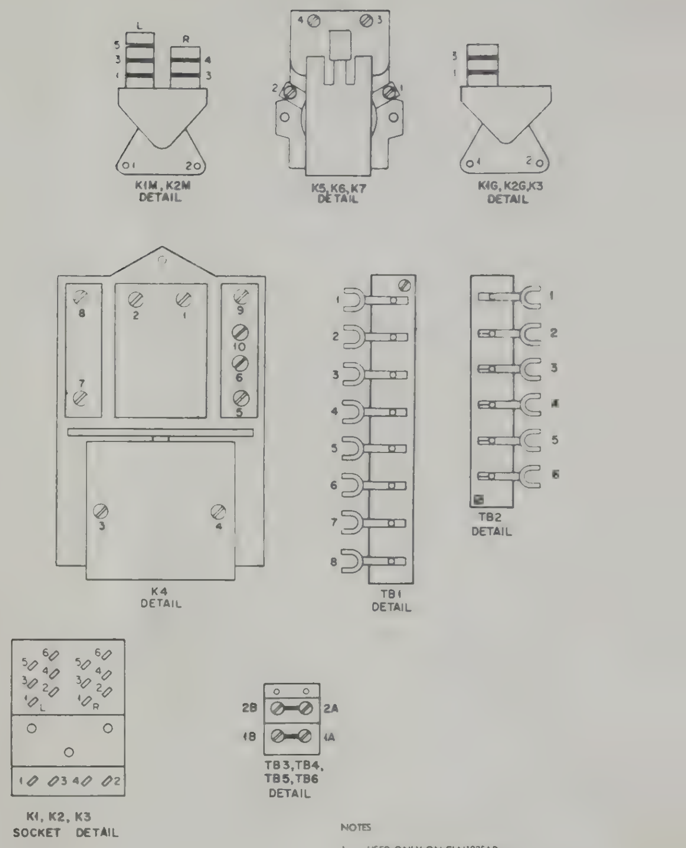
K4 NOTE 4
RED
TB2-1
TB2-2
MAGNET CLOSURE (N.O.)
CKN6018A CABLE KIT
YEL
TB2-4
TB2-5
MAGNET CLOSURE (N.C.)
K5 NOTE 2
TB2-3
TB2-6
AUXILIARY FUNCTION RELAY CLOSURE (N.O. OR N.C.)
NO CONNECTION TB1-2
ORG
TB1-4 +3.9VDC
BLU-YEL
GRAY-GRN
R4
R3
L1
L3
L5
NOTE 4 RELEASE
K4B
R1 680
CR4
CR5
NOTE 1
WHT-BLK
TB3-2A
OFF TB1-6
CR1
K1M
WHT-BRN
NOTE 4 LOCKUP
K4A
R2 680
CR6
CR7
K4 NOTE 4
BLU
WHT-RED
TB4-2A (OR TB3-1A WHEN K5 IS USED)
TB1-3 SWITCHED +18VDC
BLU-GRN
CR2
K2M
ON TB1-7
GRAY-YEL
TB1-1 +250VDC/120VAC
BLU-BRN
NOTES 2 & 5
(TB5-1B)
(TB3-1A)
K5
WHT-GRN
R3 680
CR8
CR9
CR3
K3 NOTE 2
TB4-1A (OR TB5-1B WHEN K5 IS USED)
AUXILIARY INPUT TB1-5
GRAY-RED
-250 VDC / 120 VAC (COMMON) TB1-8
BLU-WHT

CLN1036AD (DC) AND CLN1056AD(AC) GRAPPLE FUNCTION RELAY KITS



K6
WHT
TB2-1
TB2-2
GRAPPLE CLOSE
CKN6019A CABLE KIT
K7
RED
TB2-4
TB2-5
GRAPPLE OPEN
K5 NOTE 2
TB2-3
TB2-6
AUXILIARY FUNCTION RELAY CLOSURE (N.O. OR N.C.)
+250VDC / 120 VAC TB1-2
ORG
+3.9VDC TB1-4
BLU-YEL
R4
R3
L5
L3
L1
WHT-BRN TB6-1B
GRAPPLE OFF
K7
WHT-BLK
R1 680
CR4
CR5
NOTE 6
OFF TB1-6
GRAY-GRN
CR1
K1G
WHT-BLK TB6-1B
GRAPPLE ON
K6
WHT-RED
WHT-RED TB6-2A
R2 680
CR6
CR7
SWITCHED +18VDC TB1-3
BLU-GRN
CR2
K2G
ON TB1-7
GRAY-YEL
+250VDC / 120VAC TB1-1
BLU-BRN
NOTES 2 & 5
(TB5-1B)
(TB5-2B)
K5
WHT-GRN
R3 680
CR8
CR9
L1
L2
CR3
K3 NOTE 2
AUXILIARY INPUT TB1-5
GRAY-RED
-250 VDC / 120 VAC (COMMON) TB1-8
BLU-WHT

63E81049A08-0



K1M, K2M DETAIL
K5, K6, K7 DETAIL
K1G, K2G, K3 DETAIL
K4 DETAIL
TB1 DETAIL
TB2 DETAIL
K1, K2, K3 SOCKET DETAIL
TB3, TB4, TB5, TB6 DETAIL
2B
2A
1B
1A

NOTES

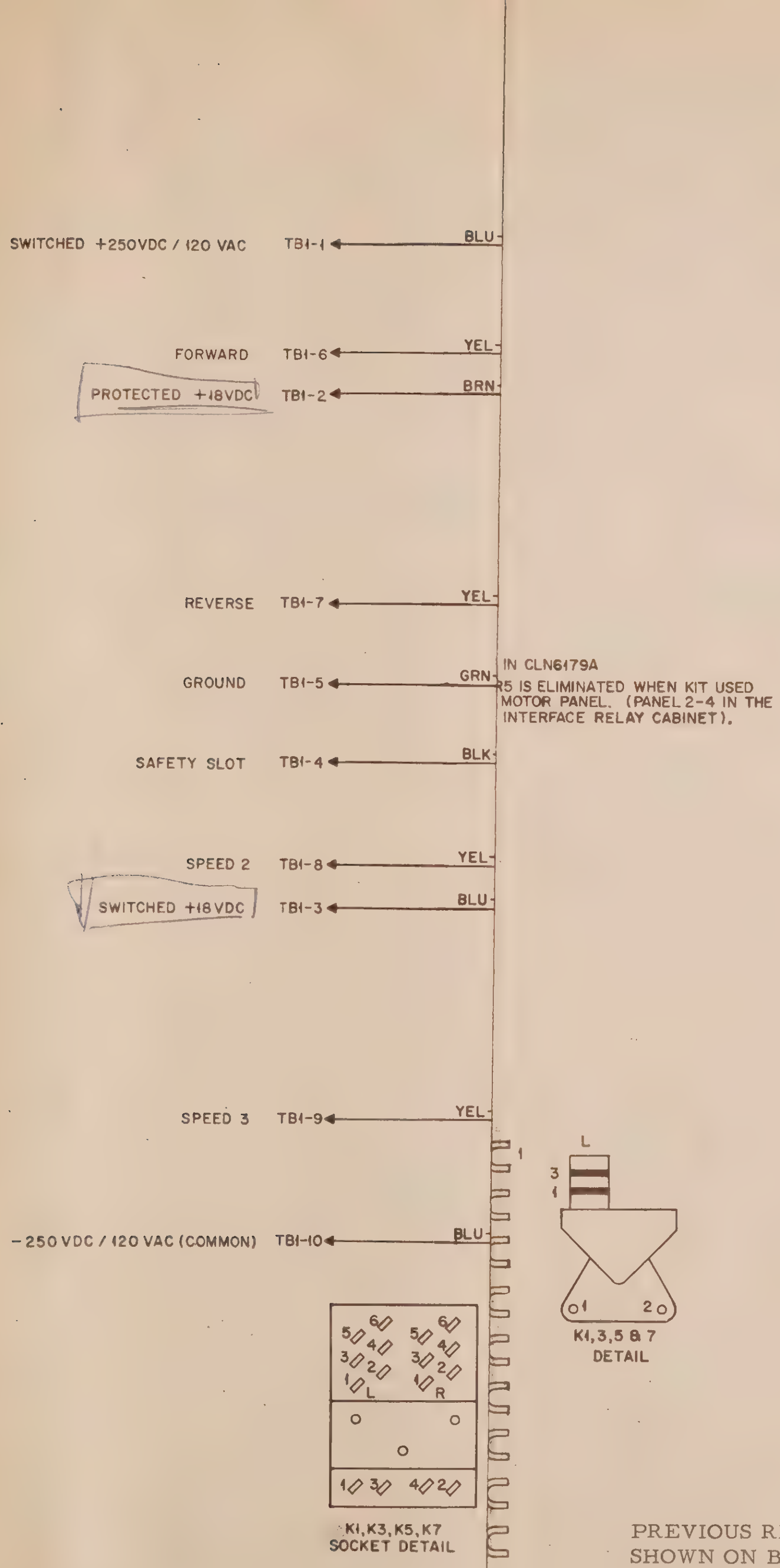
1. USED ONLY ON CLN1035AD.
2. K3 AND K5 IS AN AUXILIARY FUNCTION RELAY KIT NORMALLY NOT INCLUDED ON THIS PANEL. DASHED LINES SHOW NON-EXISTENT WIRES
3. FOR PROPER MAGNET CIRCUIT OPERATION, A JUMPER MUST BE REMOVED FROM TB200-1 TO TB200-2 IN THE INTERFACE RELAY UNIT CABINET.
4. K4 IS A MECHANICALLY LATCHING RELAY. K4A IS THE LOCKUP COIL AND K4B IS THE RELEASE COIL ONCE K4A IS ACTIVATED, THE CONTACT ARMS REMAIN PULLED IN UNTIL K4B IS ACTIVATED TO RELEASE THE CONTACT ARM.
5. WHEN K5 IS NOT USED, THE LOOSE WIRES ARE CONNECTED TO A "DUMMY" TERMINAL BOARD TB5 (TERMINALS SHOWN IN PARENTHESES)
6. USED ONLY ON CLN1036AD.

MODEL TABLE

MODEL	SUFFIX	DESCRIPTION
CLN6169A		MAGNET AND GRAPPLE PANEL
CLN1035AD		MAGNET FUNCTION RELAY KIT (DC)
CLN1055AD		MAGNET FUNCTION RELAY KIT (AC)
CLN1036AD		GRAPPLE FUNCTION RELAY KIT (DC)
CLN1056AD		GRAPPLE FUNCTION RELAY KIT (AC)

PREVIOUS REVISIONS AND PARTS LIST
SHOWN ON BACK OF THIS DIAGRAM

CLN6169A Magnet and Grapple Panel
Schematic Diagram
Motorola No. 63E81049A08-O1
8/28/68-RS


SWITCHED +250VDC / 120 VAC
TB1-1
BLU
FORWARD
TB1-6
YEL
PROTECTED +18VDC
TB1-2
BRN
REVERSE
TB1-7
YEL
GROUND
TB1-5
GRN
IN CLN6179A
R5 IS ELIMINATED WHEN KIT USED
MOTOR PANEL. (PANEL 2-4 IN THE
INTERFACE RELAY CABINET).
SAFETY SLOT
TB1-4
BLK
SPEED 2
TB1-8
YEL
SWITCHED +18VDC
TB1-3
BLU
SPEED 3
TB1-9
YEL
-250 VDC / 120 VAC (COMMON)
TB1-10
BLU
1
10
L
3
1
1
2
K1,3,5 & 7
DETAIL
6
5
4
3
2
1
L
6
5
4
3
2
1
R
1
3
4
2
K1,K3,K5,K7
SOCKET DETAIL

PREVIOUS REVISIONS AND PARTS LIST
SHOWN ON BACK OF THIS DIAGRAM.

CLN6179A (DC) and CLN6182A (AC)
3-Speed Motor Panel F+R 1,2,3
Schematic Diagram
Motorola No. 63D81049A17-01
8/28/68-RS

REVISIONS

DIAG. ISSUE	CHASSIS AND SUFFIX NO.	REF. SYMBOL	CHANGE	LOCATION
01	CLN1055AD	K8	ADDED	SCHEMATIC DIAGRAM

PARTS LIST

CLN6169A Magnet and Grapple Panel EPD-17826-O

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
		SEMICONDUCTOR DEVICE, diode: (SEE NOTE)
CR1, 2, 3	48C82392B03	silicon
		TERMINAL BOARD:
TB3, 4, 5, 6	31A50378	2 dual screw terminals
		SOCKET, relay:
XK1, 2, 3	9A83376B01	female; 16 cont

CKN6018A Magnet Function Cable Kit
(p/o CLN1035AD & CLN1055AD)
CKN6019A Grapple Function Cable Kit
(p/o CLN1036AD & CLN1056AD) EPD-17827-O

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
		TERMINAL BOARD:
TB2	31B83079B06	(fanning strip) 6 cont

CLN6105A Auxiliary Function Relay Kit, AC
(p/o CLN1055AD) EPD-17828-A

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
		RELAY, armature: telephone type;
K1M, 2M	80D83379B02	2 stack; left stack, 1 form "C"; right stack, 1 form "A"; coil res. 350 ohms ±10%; does not incl 15A83377B01 COVER
K4, 8	80C83063D02	latching type; 2 form "X"; 2 form "Y"; dual coil; incl:
K4A		lockup coil; 120 v ac; 60 cps; res. 650 ohms ±20%
K4B		release coil; 120 v ac; 60 cps; res. 140 ohms ±20%

CLN6111A Auxiliary Function Relay Kit, DC
(p/o CLN1035AD) EPD-17829-O

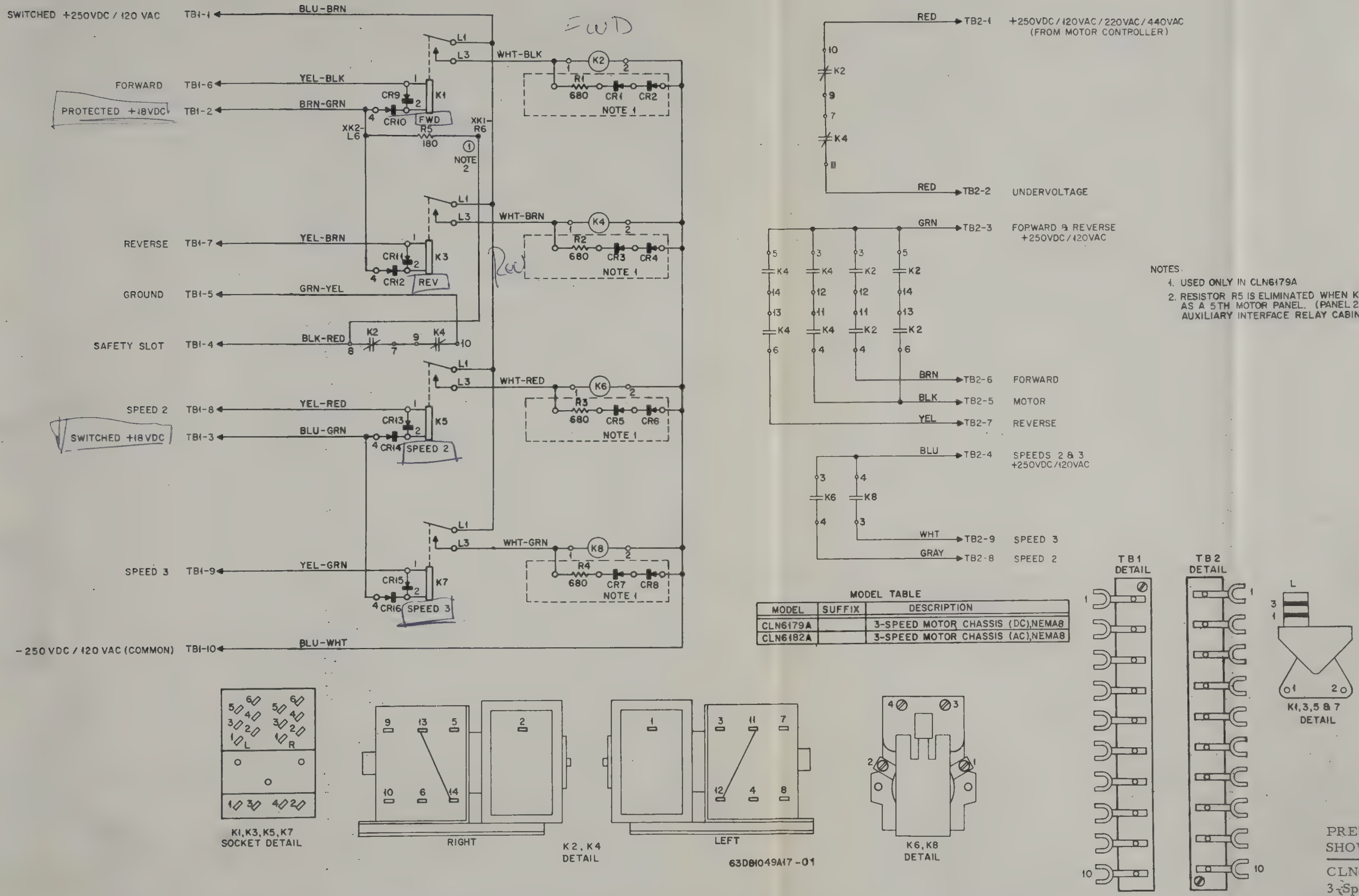
REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
		SEMICONDUCTOR DEVICE, diode: (SEE NOTE)
CR4, 5, 6, 7	48C82466H17	silicon
		RELAY, armature: telephone type;
K1M, 2M	80D83379B02	telephone type; 2 stack; left stack, 1 form "C"; right stack, 1 form "A"; coil res. 350 ohms ±10%; does not incl 15A83377B01 COVER
K4		c/o:
K4A		(2 form "X", 1 form "Y"); incl 80C83566C01 RELAY, armature: 230 v dc; 1 form "X"; coil res. 3700 ohms ±20% 39C82150F01 CONTACT ASSY: 1 form "X"; 1 form "Y"
K4B		80C83567C01 LATCH MECHANISM: 230 v dc; coil res. 2600 ohms ±20%
		RESISTOR, fixed:
R1, 2	6S5651	680 ±5%; 1/2 w

CLN6103A Auxiliary Function Relay Kit, AC
(p/o CLN1056AD)
CLN6109A Auxiliary Function Relay Kit, DC
(p/o CLN1036AD) EPD-17830-O

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
		SEMICONDUCTOR DEVICE, diode: (SEE NOTE)
CR4, 5, 6, 7		silicon (dc model)
		RELAY, armature:
K1G, 2G	80D83379B01	telephone type; 1 form "A"; coil res. 500 ohms ±10%; does not incl 15A83377B01 COVER
K6, 7	80C83261B03	120 v ac, 60 cps; 1 form "A"; coil res. 200 ohms ±10%; (ac model)
	or80C83261B01	230 v dc; 1 form "A"; coil res. 1200 ohms ±10%; (dc model)
		RESISTOR, fixed:
R1, 2	6S5651	680 ±5%; 1/2 w (dc model)

NOTE:

Replacement diodes must be ordered by Motorola part number only for optimum performance.



SWITCHED +250VDC / 120 VAC
TB1-1
BLU-BRN
FWD
L1
L3
WHT-BLK
K2
R1 680
CR1
CR2
NOTE 1
FORWARD
TB1-6
YEL-BLK
CR9
K1
PROTECTED +18VDC
TB1-2
BRN-GRN
CR10
FWD
XK2-L6
R5 180
XK1-R6
NOTE 2
WHT-BRN
K4
R2 680
CR3
CR4
REVERSE
TB1-7
YEL-BRN
CR11
K3
CR12
REV
Rev
GROUND
TB1-5
GRN-YEL
SAFETY SLOT
TB1-4
BLK-RED
K2
K4
WHT-RED
K6
R3 680
CR5
CR6
SPEED 2
TB1-8
YEL-RED
CR13
K5
SWITCHED +18VDC
TB1-3
BLU-GRN
CR14
SPEED 2
WHT-GRN
K8
R4 680
CR7
CR8
SPEED 3
TB1-9
YEL-GRN
CR15
K7
CR16
SPEED 3
-250 VDC / 120 VAC (COMMON)
TB1-10
BLU-WHT
RED
TB2-1
+250VDC / 120VAC / 220VAC / 440VAC (FROM MOTOR CONTROLLER)
K2
K4
RED
TB2-2
UNDERVOLTAGE
GRN
TB2-3
FORWARD & REVERSE +250VDC / 120VAC
K4
K4
K2
K2
BRN
TB2-6
FORWARD
BLK
TB2-5
MOTOR
YEL
TB2-7
REVERSE
BLU
TB2-4
SPEEDS 2 & 3 +250VDC / 120VAC
K6
K8
WHT
TB2-9
SPEED 3
GRAY
TB2-8
SPEED 2
TB1 DETAIL
TB2 DETAIL
K1,3,5 & 7 DETAIL
K1,K3,K5,K7 SOCKET DETAIL
RIGHT
LEFT
K2, K4 DETAIL
63D81049A17-01
K6, K8 DETAIL

NOTES.
1. USED ONLY IN CLN6179A
2. RESISTOR R5 IS ELIMINATED WHEN KIT USED AS A 5TH MOTOR PANEL. (PANEL 2-4 IN THE AUXILIARY INTERFACE RELAY CABINET).

MODEL TABLE

MODEL	SUFFIX	DESCRIPTION
CLN6179A		3-SPEED MOTOR CHASSIS (DC),NEMA8
CLN6182A		3-SPEED MOTOR CHASSIS (AC),NEMA8

PREVIOUS REVISIONS AND PARTS LIST SHOWN ON BACK OF THIS DIAGRAM.

CLN6179A (DC) and CLN6182A (AC)
3-Speed Motor Panel F+R 1,2,3
Schematic Diagram
Motorola No. 63D81049A17-01
8/28/68-RS

ST

r Kit (3-Speed AC)
r Kit (3-Speed DC)

EPD-11733-D

MOTOROLA PART NO.	DESCRIPTION
	SEMICONDUCTOR DEVICE, diode: (NOTE)
48C82466H17	silicon
48C82392B03	silicon
	RELAY, armature: telephone type;
80D83379B01	1 form "A"; coil res 500 ohms ±10%; does not incl. 15A83377B01 COVER
80C83262B03	110 v; 60 cps; 2 form "A", 2 form "B"; coil res 165 ohms ±20%; contact rating 690 v-a; 600 v a-c max. (AC model) NOTE: For replacement contacts order part number 39P83979B01 (for 3 poles). For replacement coil, order part number 24P83979B07.
or 80C83260B03	230 VDC; 2 form "A", 2 form "B" coil res. 4680 ohms ±20%; contact rating .25 v-a; 600 VDC max. (DC models) NOTE: For replacement contacts order parts number 39P83979B01 (for 3 pole). For replacement coil, order part number 24P83979B04
r80C83260B03	230 VDC; 2 form "A", 2 form "B" coil res 4680 ohms ±20% contact rating 125 v-a; 600 v d-c max (DC model) NOTE: For replacement contacts order part number 39P83979B01 (for 3 poles). For replacement coil, order part number 24P83979B04.
	RELAY, armature:
80C83261B03	115 v; 60 cps; 1 form "A"; coil res 200 ohms ±10%; contact rating 1 hp (AC model) NOTE: For replacement contacts order part number 39P83979B03 (includes one set of contacts for one pole). Specify quantity. For replacement coil, order part number 24P83979B06.
r80C83261B01	230 VDC; 1 form "A"; coil res 1200 ohms ±10%; contact rating 1/3 hp; (DC model) NOTE: For replacement contacts order part number 39P83979B03 (includes one set of contacts for one pole). Specify quantity. For replacement coil, order part number 24P83979B05.
	RESISTOR, fixed:
S565'	680 ±5%; 1/2 w
7C82291B05	180 ±10%; 5 w
	FANNING STRIP:
1B83079B02	10 female contact terminals
1B83079B04	10 female contact terminals
	SOCKET, relay:
A83376B01	16 cont.

ansistors and diodes must be ordered by
umber only for optimum performance.

REVISIONS

DIAG. ISSUE	CHASSIS AND SUFFIX NO.	REF. SYMBOL	CHANGE	LOCATION
A	CLN6100A-1 CLN6106A-1		BRN-GRN WIRE ADDED BETWEEN TB1-2 & K1-4	CABLE
			LEGEND ADDED "PROTECTED +18 VDC"	TB1-2
B	CLN6100A-2 CLN6106A-2	CR9	RELOCATED. WERE CONNECTED BETWEEN TERMINALS 1 & 4 OF RELAY SOCKETS.	K1
		CR11		K3
		CR13		K5
		CR15		K7
C	CLN6106A-3 CLN6100A-3	K2, K4	WERE 80C83262B01 OR 80C83260B01	PARTS LIST
D	CLN6100A-4 CLN6106A-4	R5	ADDED 180 OHMS	K1-4, K3-4
D1			TERMINALS TB1-4 & TB1-5 WERE AUTOMATIC SAFETY OVERRIDE OUTPUT	TB1-4, 5
D2			REDRAWN TO INCLUDE ELECTRICAL RELAY SYMBOLS	SCHEMATIC DIAGRAM
D3	CLN6100A-4	K2, 4	WERE 80C83262B03 OR 80C83260B03	PARTS LIST
D4	CLN6100A-4 CLN6106A-4	TB1	REVERSED DETAIL	SCHEMATIC DIAGRAM
D5	CLN6100A-4	K2, 4	WERE 80C83262B03 OR 80D82255F01	PARTS LIST

CLN6100A (AC) and CLN6106A (DC)
3-Speed Motor Panel
Schematic Diagram
Motorola No. 63D81033A59-D5
1/8/70-RS

REVISIONS

DIAG. ISSUE	CHASSIS AND SUFFIX NO.	REF. SYMBOL	CHANGE	LOCATION
01	CLN6182A	K2, 4	INTERCHANGED CONTACT DESIGNATIONS	SCHEMATIC DIAGRAM

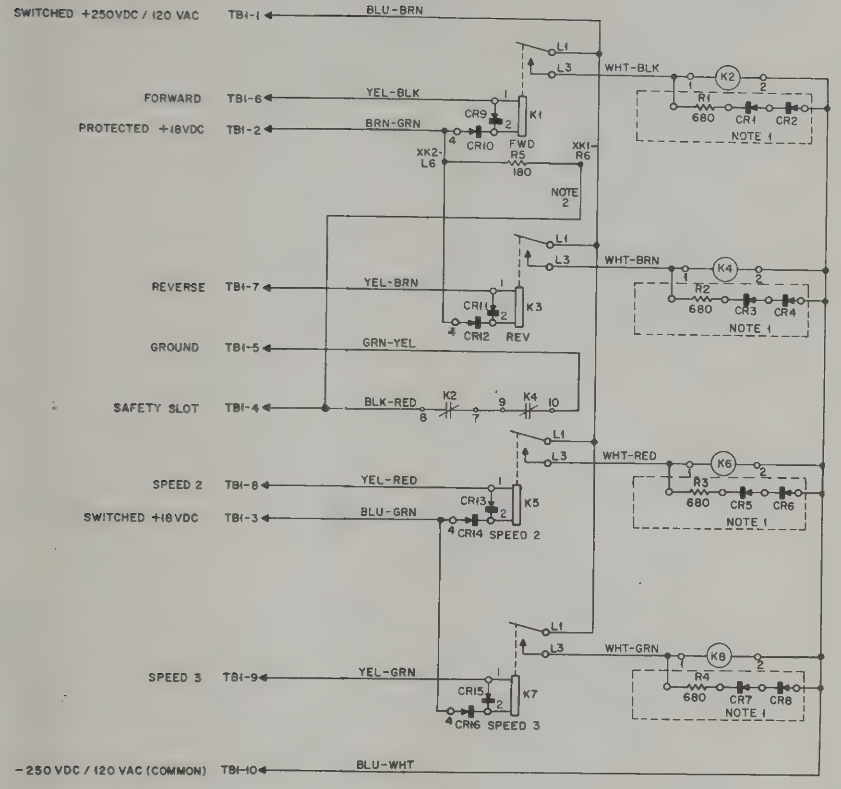
PARTS LIST

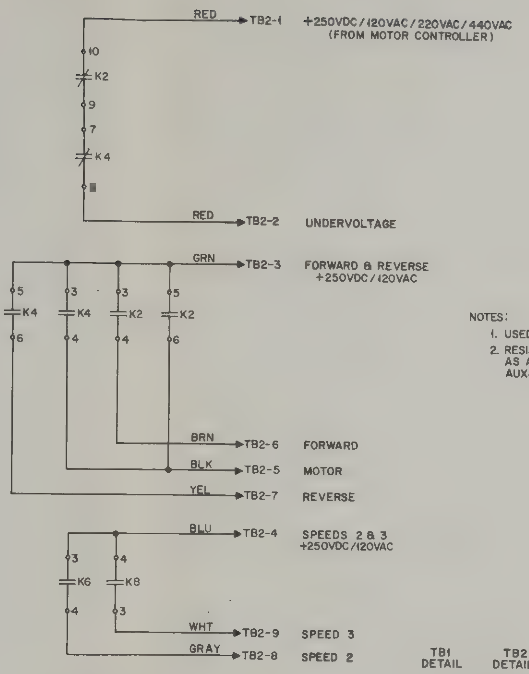
CLN6179A 3-Speed Motor Panel (DC)
CLN6182A 3-Speed Motor Panel (AC) EPD-17831-O

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
		SEMICONDUCTOR DEVICE, diode: (SEE NOTE)
CR1 thru 8	48C82466H17	silicon (dc model)
CR9 thru 16	48C82392B03	silicon
		RELAY, armature:
K1, 3, 5, 7	80D83379B01	telephone type; 1 form "A"; coil res. 500 ohms ±10%; does not incl 15A83377B01 COVER
K2, 4	80C83262B04	120 v ac, 60 cps; 4 form "A"; 2 form "B"; coil res. 77 ohms ±20%; (ac model)
	or80C83260B04	230 v dc; 4 form "A"; 2 form "B"; coil res. 4680 ohms ±20% (dc model)
K6, 8	80C83261B03	120 v ac; 60 cps; 1 form "A"; coil res. 200 ohms ±10%; (ac model)
	or80C83261B01	230 v dc; 1 form "A"; coil res. 12000 ohms ±10% (dc model)
		RESISTOR, fixed:
R1, 2, 3, 4	6S5651	680 ±5%; 1/2 w (dc model)
R5	17C82291B05	180 ±10%; 5 w
		SOCKET, relay:
XK1, 3, 5, 7	9A83376B01	female; 16 cont

NOTE:

Replacement diodes must be ordered by Motorola part number only for optimum performance.


SWITCHED +250VDC / 120 VAC
TB1-1
BLU-BRN
FORWARD
TB1-6
YEL-BLK
PROTECTED +18VDC
TB1-2
BRN-GRN
L1
L3
WHT-BLK
K2
R1
680
CR1
CR2
NOTE 1
CR9
CR10
K1
FWD
XK2-L6
R5
180
XK1-R6
NOTE 2
REVERSE
TB1-7
YEL-BRN
WHT-BRN
K4
R2
680
CR3
CR4
CR11
CR12
K3
REV
GROUND
TB1-5
GRN-YEL
SAFETY SLOT
TB1-4
BLK-RED
K2
K4
8
7
9
10
SPEED 2
TB1-8
YEL-RED
SWITCHED +18VDC
TB1-3
BLU-GRN
WHT-RED
K6
R3
680
CR5
CR6
CR13
CR14
K5
SPEED 2
SPEED 3
TB1-9
YEL-GRN
WHT-GRN
K8
R4
680
CR7
CR8
CR15
CR16
K7
SPEED 3
-250 VDC / 120 VAC (COMMON)
TB1-10
BLU-WHT

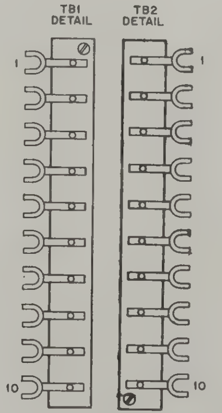

RED
TB2-1
+250VDC/120VAC/220VAC/440VAC (FROM MOTOR CONTROLLER)
10
K2
9
7
K4
RED
TB2-2
UNDERVOLTAGE
GRN
TB2-3
FORWARD & REVERSE +250VDC/120VAC
5
K4
6
3
K4
4
3
K2
4
5
K2
6
BRN
TB2-6
FORWARD
BLK
TB2-5
MOTOR
YEL
TB2-7
REVERSE
BLU
TB2-4
SPEEDS 2 & 3 +250VDC/120VAC
3
K6
4
4
K8
3
WHT
TB2-9
SPEED 3
GRAY
TB2-8
SPEED 2

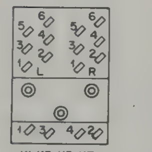
NOTES:

1. USED ONLY IN CLN6106A
2. RESISTOR R5 IS ELIMINATED WHEN KIT USED AS A 5TH MOTOR PANEL. (PANEL 2-4 IN TH AUXILIARY INTERFACE RELAY CABINET).

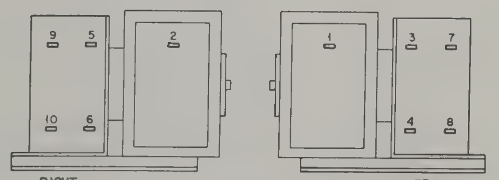
MODEL TABLE

MODEL	SUFFIX	DESCRIPTION
CLN6100A	4	3-SPEED MOTOR PANEL ,(AC)
CLN6106A	4	3-SPEED MOTOR PANEL ,(DC)


TB1 DETAIL
TB2 DETAIL
1
10
1
10

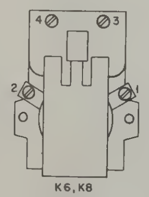

5
6
4
3
2
L
6
5
4
3
2
R
1
2

K1,K3,K5,K7 SOCKET DETAIL

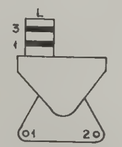

9
5
10
6
2
1
3
7
4
8
RIGHT
LEFT

K2, K4 DETAIL

63D81033A59-D5



K6, K8 DETAIL



K1,K3,K5 & K7 DETAIL

PARTS LIST

CLN6100A Motor Kit (3-Speed AC)
CLN6106A Motor Kit (3-Speed DC) EPD-11733-D

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
		SEMICONDUCTOR DEVICE, diode: (NOTE)
CR1 thru 8	48C82466H17	silicon
CR9 thru 16	48C82392B03	silicon
		RELAY, armature: telephone type;
K1, 3, 5, 7	80D83379B01	1 form "A"; coil res 500 ohms ±10%; does not incl. 15A83377B01 COVER
K2, 4	80C83262B03	110 v; 60 cps; 2 form "A", 2 form "B"; coil res 165 ohms ±20%; contact rating 690 v-a; 600 v a-c max. (AC model) NOTE: For replacement contacts order part number 39P83979B01 (for 3 poles). For replacement coil, order part number 24P83979B07.
	or 80C83260B03	230 VDC; 2 form "A", 2 form "B" coil res. 4680 ohms ±20%; contact rating .25 v-a; 600 VDC max. (DC models) NOTE: For replacement contacts order parts number 39P83979B01 (for 3 pole). For replacement coil, order part number 24P83979B04
	or80C83260B03	230 VDC; 2 form "A", 2 form "B" coil res 4680 ohms ±20% contactrating 125v-a;600 v d-c max (DC model) NOTE: For replacement contacts order part number 39P83979B01 (for 3 poles). For replacement coil, order part number 24P83979B04.
		RELAY, armature:
K6, 8	80C83261B03	115 v; 60 cps; 1 form "A"; coil res 200 ohms ±10%; contact rating 1 hp (AC model) NOTE: For replacement contacts order part number 39P83979B03 (includes one set of contacts for one pole). Specify quantity. For replacement coil, order part number 24P83979B06.
	or80C83261B01	230 VDC; 1 form "A"; coil res 1200 ohms ±10%; contact rating 1/3 hp; (DC model) NOTE: For replacement contacts order part number 39P83979B03 (includes one set of contacts for one pole). Specify quantity. For replacement coil, order part number 24P83979B05.
		RESISTOR, fixed:
R1, 2, 3, 4	6S565'	680 ±5%; 1/2 w
R5	17C82291B05	180 ±10%; 5 w
		FANNING STRIP:
TB1	31B83079B02	10 female contact terminals
TB2	31B83079B04	10 female contact terminals
		SOCKET, relay:.
XK1, 3, 5, 7	9A83376B01	16 cont.

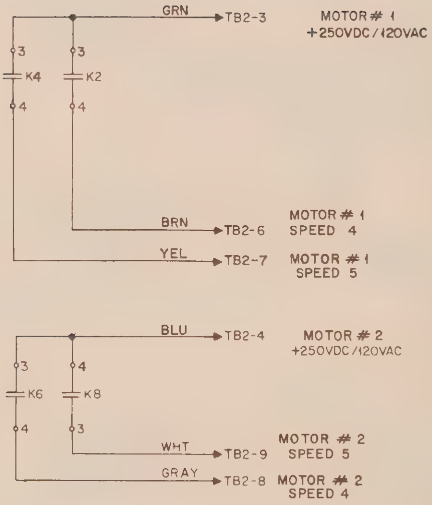
NOTE:

Replacement transistors and diodes must be ordered by Motorola part number only for optimum performance.

REVISIONS

DIAG ISSUE	CHASSIS AND SUFFIX NO.	REF. SYMBOL	CHANGE	LOCATION
A	CLN6100A-1 CLN6106A-1		BRN-GRN WIRE ADDED BETWEEN TB1-2 & K1-4	CABLE
			LEGEND ADDED 'PROTECTED +18 [illegible]	TB1-2
B	CLN6100A-2 CLN6106A-2	CR[illegible]	RELOCATED. WERE CONNECTED BETWEEN TERMINALS 1 & 4 OF RELAY SOCKETS.	K1
		CR1[illegible]		K[illegible]
		CR1[illegible]		K[illegible]
		CR1[illegible]		K[illegible]
C	CLN6106A-3 CLN6100A-3	K2, K4	WERE 80C83262B01 OR 80C83260B01	PARTS LIST
D	CLN6100A-4 CLN6106A-4	R5	ADDED 180 OHMS	[illegible]
D1			TERMINALS TB1-4 & TB1-5 WERE AUTOMATIC SAFETY OVERRIDE OUTPUT	[illegible]
D2			REDRAWN TO INCLUDE ELECTRICAL RELAY SYMBOLS	SCHEMATIC DIAGRAM
D3	CLN6106A-4	K2, 4	WERE 80C83262B03 OR 80C83260B03	PARTS LIST
D4	CLN6100A-4 CLN6106A-4	TB1	REVERSED DETAIL	SCHEMATIC DIAGRAM
D5	CLN6100A-4	K2, 4	WERE 80C83262B03 OR 80D82255F01	PARTS LIST

CLN6100A (AC) and CLN6106A (DC)
3-Speed Motor Panel
Schematic Diagram
Motorola No. 63D81033A59-D5
1/8/70-RS

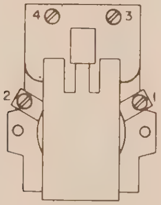

GRN
TB2-3
MOTOR # 1
+250VDC/120VAC
3
K4
4
3
K2
4
BRN
TB2-6
MOTOR # 1
SPEED 4
YEL
TB2-7
MOTOR # 1
SPEED 5
BLU
TB2-4
MOTOR # 2
+250VDC/120VAC
3
K6
4
4
K8
3
WHT
TB2-9
MOTOR # 2
SPEED 5
GRAY
TB2-8
MOTOR # 2
SPEED 4

NOTES

1. USED ONLY IN CLN6107A
2. JUMPER JU1 IS OMITTED WHEN AUXILIARY TROLLEY IS USED

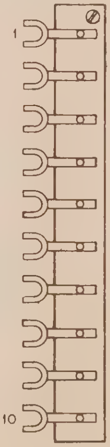
MODEL TABLE

MODEL	SUFFIX	DESCRIPTION
CLN6101A	1	5 SPEED MOTOR PANEL, 2 MOTORS, AC
CLN6107A	1	5 SPEED MOTOR PANEL, 2 MOTORS, DC

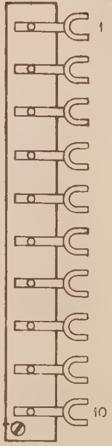


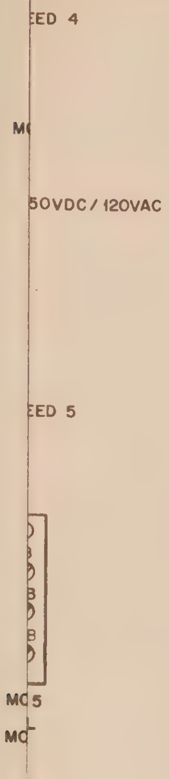
K2, K4, K6, K8
DETAIL

TB1
DETAIL



TB2
DETAIL





PARTS LIST

CLN6121B Motor Select Kit EPD-14031-B

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
CR1 thru 14	48C82392B03	SEMICONDUCTOR DEVICE, diode: (SEE NOTE) silicon
K3, 4	80D83379B02	RELAY, telephone: 1 form "A"; 1 form "C"; coil res. 350 ohms; 9 v
TB1, 2	31B83079B02	STRIP, fanning: 10 cont; term. spacing .437"
TB3	31B83079B04	10 cont; term. spacing .562"
TB4, 5	31K807190	BOARD, terminal: 3 screw terminals
XK1, 2, 3, 4	9A83376B01	SOCKET, relay: male; 16 cont.

CLN6103A Auxiliary Function Relay Kit(N.O./AC) EPD-21846-O

K1	80D83379B01	RELAY, armature: telephone type; 1 form "A"
K2	80C83261B03	power; 1 form "A"; coil res 200 ohms; contact rating 1 hp @ 115 v a-c (N.O.) NOTE: For replacement contacts, order part number 39P83979B03 (includes one set of contacts for one pole). Specify quantity. For replacement coil, order part number 24P83979B06.

CLN6109A Auxiliary Function Relay Kit (N.O./DC) EPD-22086-O

CR6 thru 15	48C82466H17	SEMICONDUCTOR DEVICE, diode: (SEE NOTE) silicon
K1	80D83379B01	RELAY, armature: telephone type; 1 form "A"
K2	80C83261B01	power; 1 form "A"; coil res 12K ohms; contact rating 1/3 hp @ 230 v d-c NOTE: For replacement contacts, order part number 39P83979B03 (includes one set of contacts for one pole). Specify quantity. For replacement coil, order part number 24P83979B05.
R1, 2	6S5651	RESISTOR, fixed: 680 ±5%; 1/2 w
	NON-REFERENCED ITEMS	
	31A813331	BOARD terminal: 6 screw term.

NOTE:

Replacement diodes must be ordered by Motorola part number only for optimum performance.

REVISIONS

AND NO.	REF. SYMBOL	CHANGE	LOCATION
		MOTOR #2 WAS #1	TB5-4, 6, 7
	R1	ADDED	PARTS LIST
	TB3	WAS TB5	
	TB5	WAS TB3	
		REDRAWN TO INCLUDE ELECTRICAL RELAY SYMBOLS	DIAGRAM
	CR2	WAS REVERSED	DIAGRAM
	TB1, 2		

MO

CLN6121B Motor Select Kit
Schematic and Intercabling Diagram
Motorola No. 63D81039A37-O3
8/28/68-RS

4+5 Speed

PARTS LIST

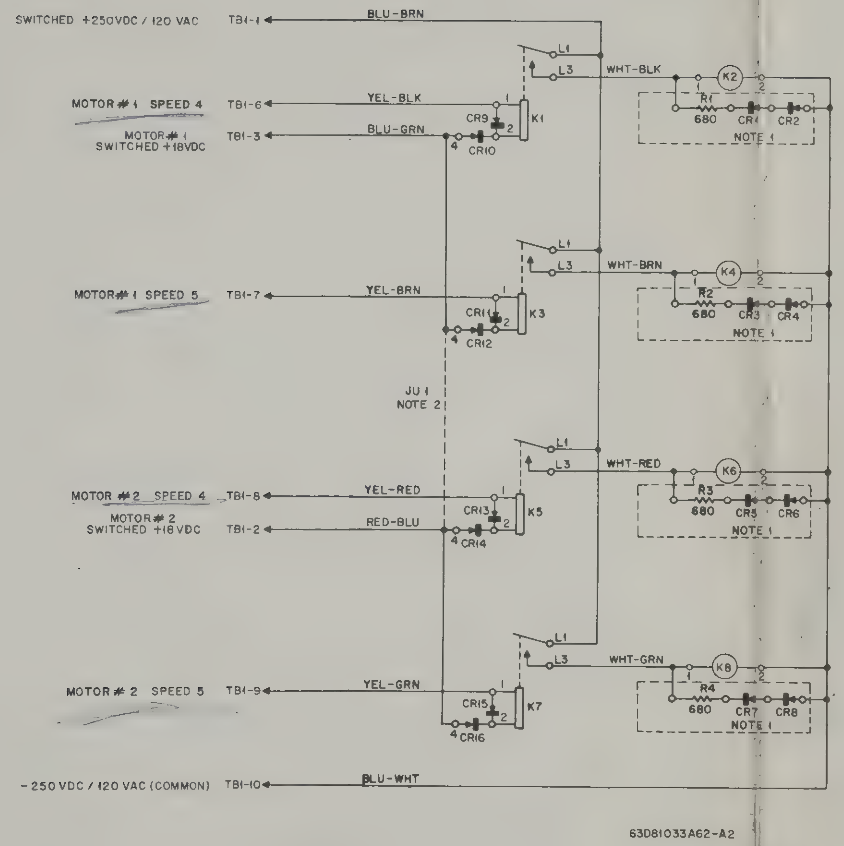
CLN6101A Motor Chassis (5-Speed AC)
CLN6107A Motor Chassis (5-Speed DC)

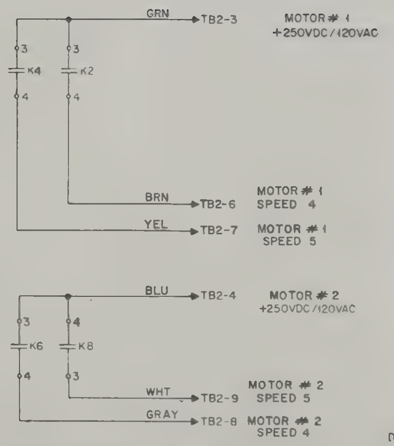
EPD-11731-O

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
		SEMICONDUCTOR DEVICE, diode: (NOTE)
CR1 thru 8	48C82466H17	silicon
CR9 thru 16	48C82392B03	silicon
		RELAY, armature: telephone type;
K1, 3, 5, 7	80D83379B01	1 form "A"; coil res 500 ohms ±10%; does not incl. 15A83377B01 COVER
		RELAY, armature:
K2, 4, 6, 8	80C83261B03	115 v; 60 cps; 1 form "A"; coil res 200 ohms ±10%; contact rating 1 hp; (AC only)
	or80C83261B01	230 VDC; 1 form "A"; coil res 12K ohms ±10%; contact rating 1/3 hp (DC only)
		RESISTOR, fixed:
R1, 2, 3, 4	6S5651	680 ±5%; 1/2 w
		FANNING STRIP:
TB1	31B83079B02	10 female contact terminals
TB2	31B83079B04	10 female contact terminals
		SOCKET, relay:
XK1, 3, 5, 7	9A83376B01	16 contact

REVISIONS

DIAG. ISSUE	CHASSIS AND SUFFIX NO.	REF. SYMBOL	CHANGE	LOCATION
A	CLN6101A-1 CLN6107A-1	CR9 CR11 CR13 CR15	RELOCATED, WERE CONNECTED BETWEEN TERMINALS 1 & 4 OF RELAY SOCKETS	K1 K3 K5 K7
			BLU-YEL WIRE REMOVED FROM TB1-4 & K5-4 RED-BLU WIRE ADDED BETWEEN TB1-2 & K5-4 LEGEND MOVED FROM TB1-4 TO TB1-2	CABLE
A1			REDRAWN TO INCLUDE ELECTRICAL RELAY SYMBOLS	SCHEMATIC DIAGRAM
A2		TB1	REVERSED DETAIL	SCHEMATIC DIAGRAM

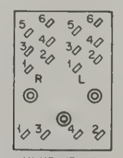

SWITCHED +250VDC / 120 VAC
TB1-1
BLU-BRN
L1
L3
WHT-BLK
K2
1
2
R1
680
CR1
CR2
NOTE 1
MOTOR #1 SPEED 4
TB1-6
YEL-BLK
CR9
K1
MOTOR #1 SWITCHED +18VDC
TB1-3
BLU-GRN
4
CR10
WHT-BRN
K4
R2
680
CR3
CR4
NOTE 1
MOTOR #1 SPEED 5
TB1-7
YEL-BRN
CR11
K3
CR12
JU1 NOTE 2
WHT-RED
K6
R3
680
CR5
CR6
NOTE 1
MOTOR #2 SPEED 4
TB1-8
YEL-RED
CR13
K5
MOTOR #2 SWITCHED +18VDC
TB1-2
RED-BLU
CR14
WHT-GRN
K8
R4
680
CR7
CR8
NOTE 1
MOTOR #2 SPEED 5
TB1-9
YEL-GRN
CR15
K7
CR16
-250 VDC / 120 VAC (COMMON)
TB1-10
BLU-WHT
63D81033A62-A2


GRN
TB2-3
MOTOR #1 +250VDC/120VAC
3
K4
4
K2
BRN
TB2-6
MOTOR #1 SPEED 4
YEL
TB2-7
MOTOR #1 SPEED 5
BLU
TB2-4
MOTOR #2 +250VDC/120VAC
K6
K8
WHT
TB2-9
MOTOR #2 SPEED 5
GRAY
TB2-8
MOTOR #2 SPEED 4

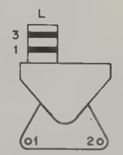
NOTES
1. USED ONLY IN CLN6107A
2. JUMPER JU1 IS OMITTED WHEN AUXILIARY TROLLEY IS USED

MODEL TABLE

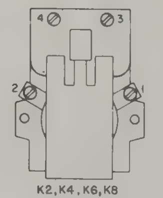
MODEL	SUFFIX	DESCRIPTION
CLN6101A	1	5 SPEED MOTOR PANEL, 2 MOTORS, AC
CLN6107A	1	5 SPEED MOTOR PANEL, 2 MOTORS, DC



K1, K3, K5, K7
SOCKET DETAIL



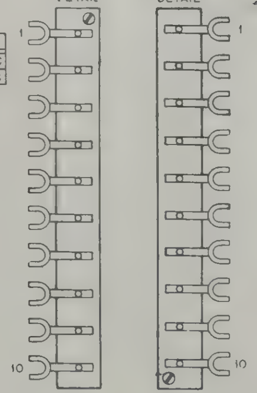
K1, K3, K5, K7
DETAIL



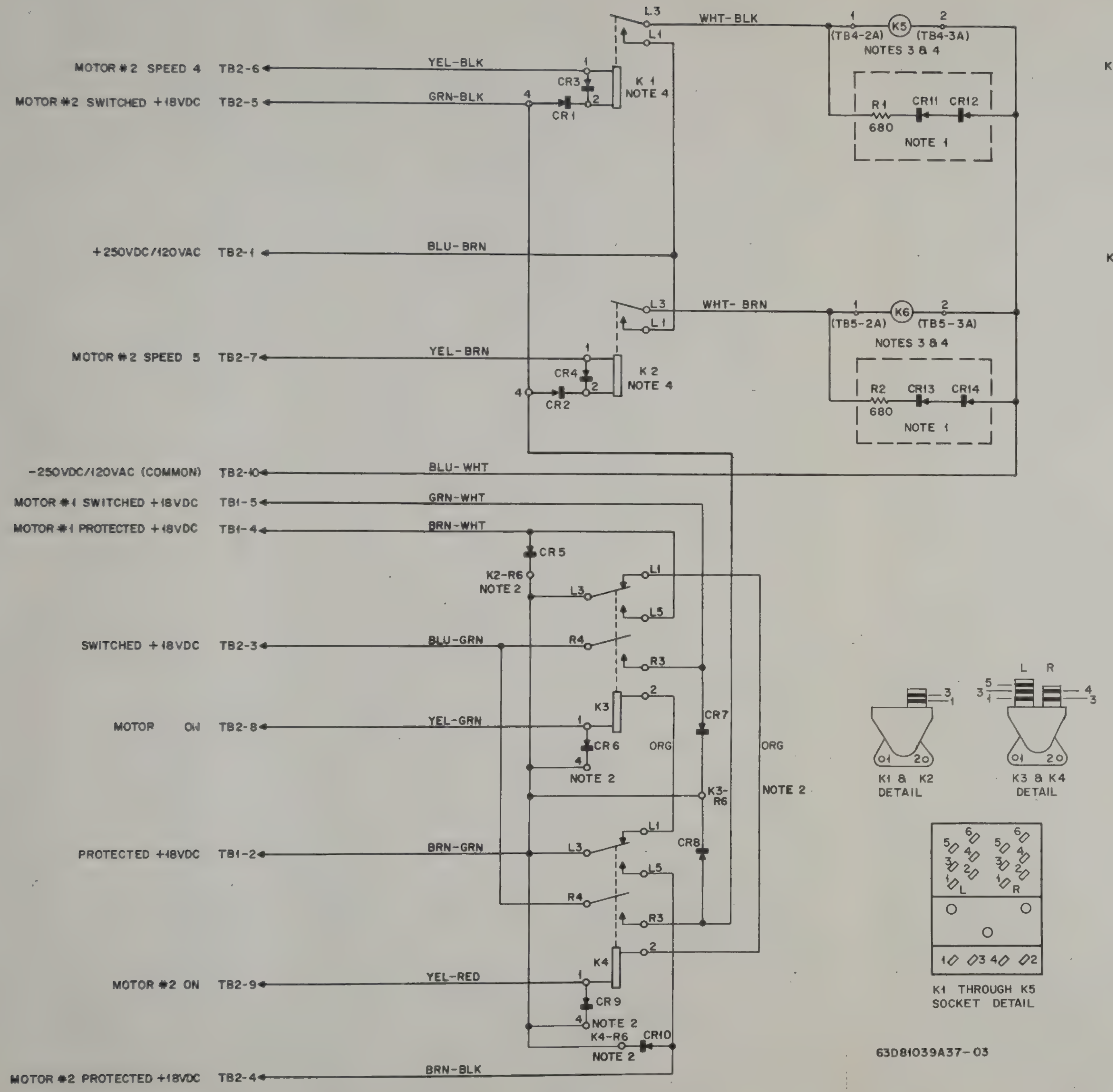
K2, K4, K6, K8
DETAIL

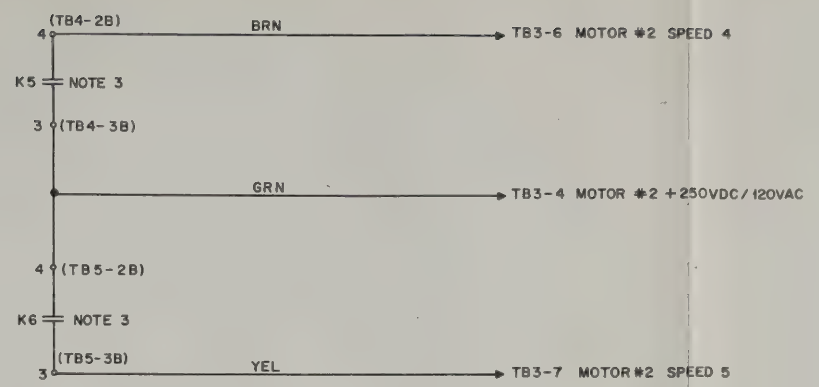
TB1
DETAIL

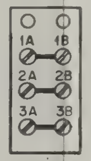
TB2
DETAIL

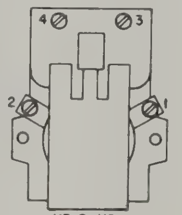


CLN6101A (AC) and CLN6107A (DC)
5-Speed Motor Panel
Schematic Diagram
Motorola No. 63D81033A62-A2
8/28/68-RS

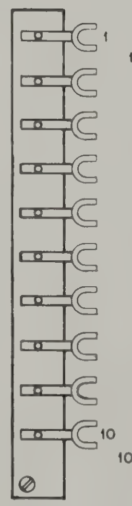

L3
L1
WHT-BLK
K5
(TB4-2A)
(TB4-3A)
NOTES 3 & 4
R1
680
CR11
CR12
NOTE 1
MOTOR #2 SPEED 4 TB2-6
YEL-BLK
CR3
K1
NOTE 4
MOTOR #2 SWITCHED +18VDC TB2-5
GRN-BLK
CR1
+250VDC/120VAC TB2-1
BLU-BRN
WHT-BRN
K6
(TB5-2A)
(TB5-3A)
NOTES 3 & 4
R2
680
CR13
CR14
NOTE 1
MOTOR #2 SPEED 5 TB2-7
YEL-BRN
CR4
K2
NOTE 4
CR2
-250VDC/120VAC (COMMON) TB2-10
BLU-WHT
MOTOR #1 SWITCHED +18VDC TB1-5
GRN-WHT
MOTOR #1 PROTECTED +18VDC TB1-4
BRN-WHT
CR5
K2-R6
NOTE 2
L3
L1
L5
SWITCHED +18VDC TB2-3
BLU-GRN
R4
R3
K3
CR6
NOTE 2
ORG
CR7
ORG
NOTE 2
MOTOR ON TB2-8
YEL-GRN
K3-R6
PROTECTED +18VDC TB1-2
BRN-GRN
L3
L1
L5
CR8
R4
R3
K4
MOTOR #2 ON TB2-9
YEL-RED
CR9
NOTE 2
K4-R6
CR10
NOTE 2
MOTOR #2 PROTECTED +18VDC TB2-4
BRN-BLK


(TB4-2B)
4
BRN
TB3-6 MOTOR #2 SPEED 4
K5
NOTE 3
3
(TB4-3B)
GRN
TB3-4 MOTOR #2 +250VDC/120VAC
4
(TB5-2B)
K6
NOTE 3
(TB5-3B)
3
YEL
TB3-7 MOTOR #2 SPEED 5

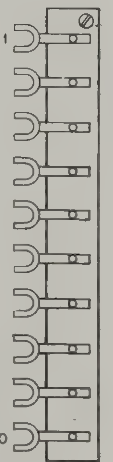

1A
1B
2A
2B
3A
3B
TB4 & 5 DETAIL



K5 & K6 DETAIL



TB3 DETAIL


1
10
TB1, TB2 DETAIL

NOTES:
1. USED ONLY ON CLN6109A.
2. USED AS TIE POINT ONLY.
3. WHEN K5 AND/OR K6 ARE NOT USED, THE LOOSE WIRES ARE CONNECTED TO "DUMMY" TERMINAL BOARDS TB4 AND TB5. (TERMINALS SHOWN IN PARENTHESES.)
4. RELAYS K1, K2, K5 AND K6 ARE USED ONLY IN 5-SPEED MOTOR SYSTEMS.

3
1
1
2
K1 & K2 DETAIL

L
R
5
3
1
4
3
1
2
K3 & K4 DETAIL

6
5
4
3
2
1
L
6
5
4
3
2
1
R
1
3
4
2
K1 THROUGH K5 SOCKET DETAIL

63D81039A37-03

MODEL TABLE

MODEL	SUFFIX	DESCRIPTION
CLN6121B		MOTOR SELECT KIT
CLN6103A		AUXILLIARY FUNCTION RELAY KIT (AC)
CLN6109A		AUXILLIARY FUNCTION RELAY KIT (DC)

REVISIONS

DIAG. ISSUE	CHASSIS AND SUFFIX NO.	REF. SYMBOL	CHANGE	LOCATION
O1			MOTOR #2 WAS #1	TB5-4, 6, 7
O2		R1	ADDED	PARTS LIST
		TB3	WAS TB5	
		TB5	WAS TB3	
			REDRAWN TO INCLUDE ELECTRICAL RELAY SYMBOLS	DIAGRAM
O3		CR2 TB1, 2	WAS REVERSED	DIAGRAM

PARTS LIST

CLN6121B Motor Select Kit EPD-14031-B

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
		SEMICONDUCTOR DEVICE, diode: (SEE NOTE)
CR1 thru 14	48C82392B03	silicon
		RELAY, telephone:
K3, 4	80D83379B02	1 form "A"; 1 form "C"; coil res. 350 ohms; 9 v
		STRIP, fanning:
TB1, 2	31B83079B02	10 cont; term. spacing .437
TB3	31B83079B04	10 cont; term. spacing .562
		BOARD, terminal:
TB4, 5	31K807190	3 screw terminals
		SOCKET, relay:
XK1, 2, 3, 4	9A83376B01	male; 16 cont.

CLN6103A Auxiliary Function Relay Kit(N.O./AC) EPD-21846-O

		RELAY, armature
K1	80D83379B01	telephone type; 1 form "A"
K2	80C83261B03	power; 1 form "A"; coil res 200 ohms; contact rating 1 hp @ 115 v a-c (N.O.)
		NOTE: For replacement contacts, order part number 39P83979B03 (includes one set of contacts for one pole). Specify quantity. For replacement coil, order part number 24P83979B06.

CLN6109A Auxiliary Function Relay Kit (N.O./DC) EPD-22086-O

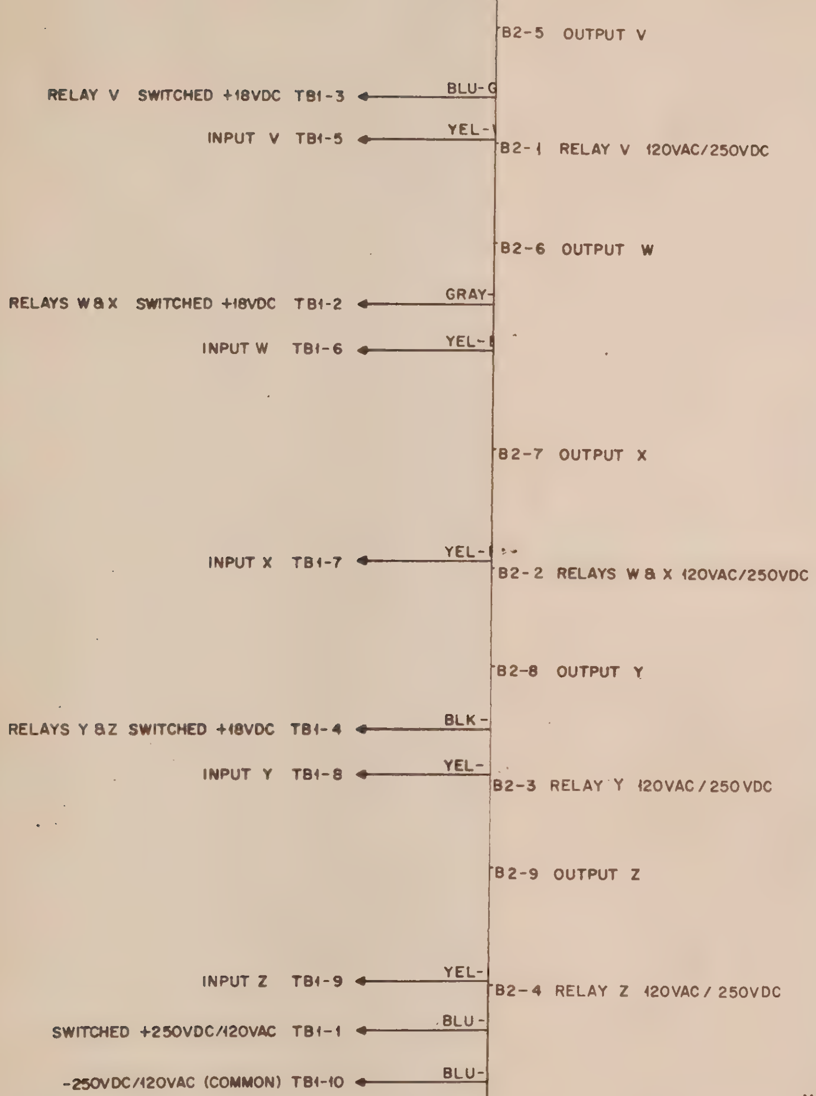
		SEMICONDUCTOR DEVICE, diode: (SEE NOTE)
CR6 thru 15	48C82466H17	silicon
		RELAY, armature:
K1	80D83379B01	telephone type; 1 form "A"
K2	80C83261B01	power; 1 form "A"; coil res 12K ohms; contact rating 1/3 hp @ 230 v d-c
		NOTE: For replacement contacts, order part number 39P83979B03 (includes one set of contacts for one pole). Specify quantity. For replacement coil, order part number 24P83979B05.
		RESISTOR, fixed:
R1, 2	6S5651	680 ±5%; 1/2 w
	NON-REFERENCED ITEMS	
	31A813331	BOARD terminal: 6 screw term.

NOTE:

Replacement diodes must be ordered by Motorola part number only for optimum performance.

CLN6121B Motor Select Kit
Schematic and Intercabling Diagram
Motorola No. 63D81039A37-O3
8/28/68-RS

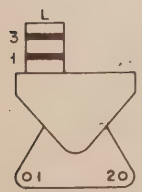
4+5 speed


TB2-5 OUTPUT V
RELAY V SWITCHED +18VDC TB1-3
BLU-G
INPUT V TB1-5
YEL-
TB2-1 RELAY V 120VAC/250VDC
TB2-6 OUTPUT W
RELAYS W & X SWITCHED +18VDC TB1-2
GRAY-
INPUT W TB1-6
YEL-
TB2-7 OUTPUT X
INPUT X TB1-7
YEL-
TB2-2 RELAYS W & X 120VAC/250VDC
TB2-8 OUTPUT Y
RELAYS Y & Z SWITCHED +18VDC TB1-4
BLK-
INPUT Y TB1-8
YEL-
TB2-3 RELAY Y 120VAC / 250VDC
TB2-9 OUTPUT Z
INPUT Z TB1-9
YEL-
TB2-4 RELAY Z 120VAC / 250VDC
SWITCHED +250VDC/120VAC TB1-1
BLU-
-250VDC/120VAC (COMMON) TB1-10
BLU-

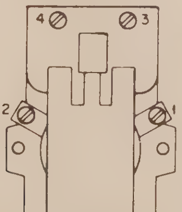
TION

NG WIRES
ROUGH TB7

H THE
S.
THE
KITS.
LN6176A



K1 THROUGH K5
DETAIL



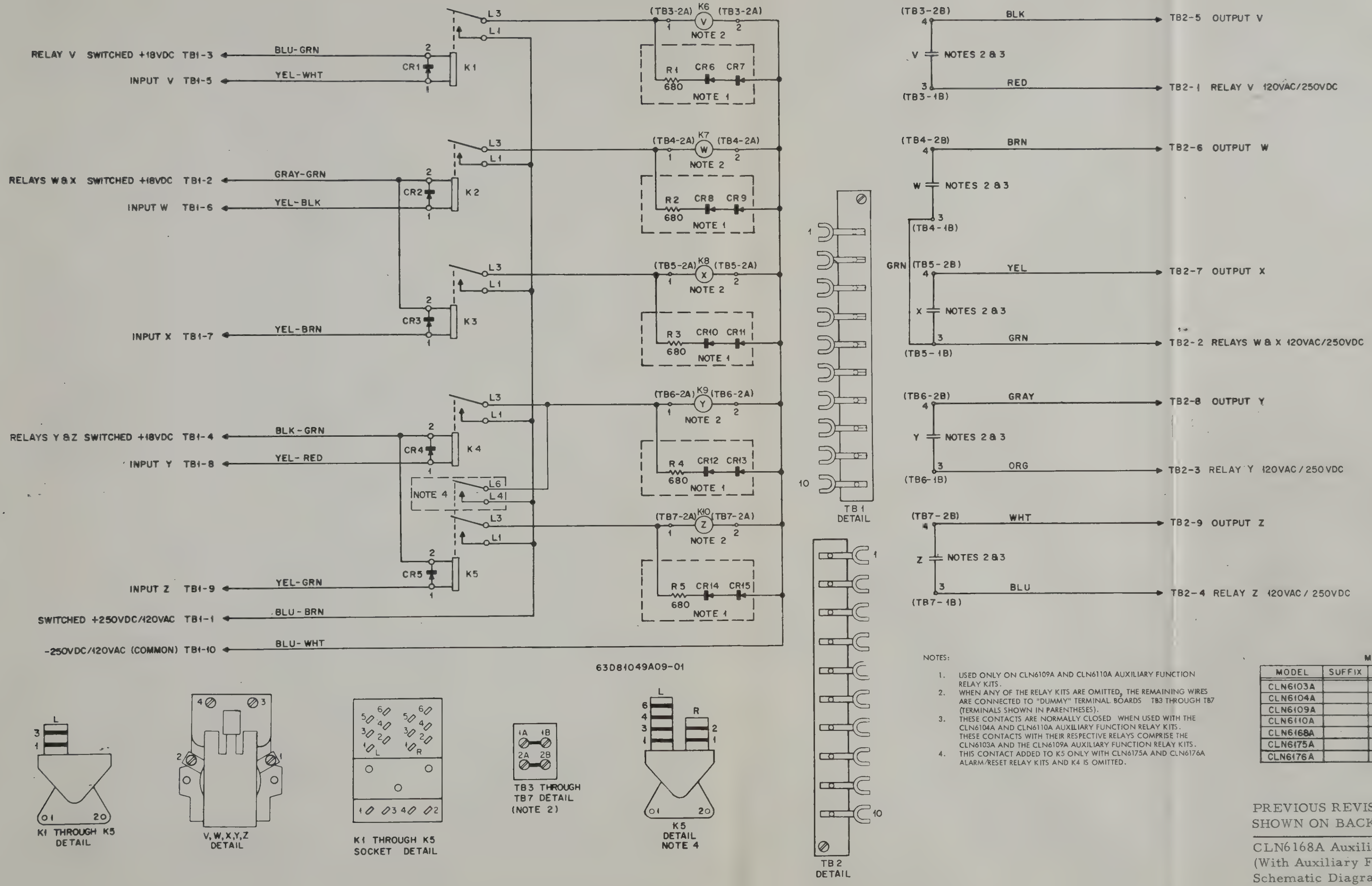
V, W, X, Y, Z
DETAIL

MODEL TABLE

MODEL	SUFFIX	DESCRIPTION	
CLN6103A		N.O. / AC	AUXILIARY FUNCTION RELAY KITS
CLN6104A		N.C. / AC	
CLN6109A		N.O. / DC	
CLN6110A		N.C. / DC	
CLN6168A		AUXILIARY FUNCTION PANEL	
CLN6175A		ALARM & RESET RELAY KIT (DC)	
CLN6176A		ALARM & RESET RELAY KIT (AC)	

PREVIOUS REVISIONS AND PARTS LIST
SHOWN ON BACK OF THIS DIAGRAM

CLN6168A Auxiliary Function Relay Panel
(With Auxiliary Function Relay Kits)
Schematic Diagram
Motorola No. 63D81049A09-01
8/28/68-RS


RELAY V SWITCHED +18VDC TB1-3
INPUT V TB1-5
BLU-GRN
YEL-WHT
CR1
K1
L3
L1
RELAYS W & X SWITCHED +18VDC TB1-2
INPUT W TB1-6
GRAY-GRN
YEL-BLK
CR2
K2
INPUT X TB1-7
YEL-BRN
CR3
K3
RELAYS Y & Z SWITCHED +18VDC TB1-4
INPUT Y TB1-8
BLK-GRN
YEL-RED
CR4
K4
NOTE 4
L6
L4
INPUT Z TB1-9
YEL-GRN
CR5
K5
SWITCHED +250VDC/120VAC TB1-1
BLU-BRN
-250VDC/120VAC (COMMON) TB1-10
BLU-WHT
(TB3-2A) K6 (TB3-2A)
V
NOTE 2
R1 680
CR6 CR7
NOTE 1
(TB4-2A) K7 (TB4-2A)
W
R2 680
CR8 CR9
(TB5-2A) K8 (TB5-2A)
X
R3 680
CR10 CR11
(TB6-2A) K9 (TB6-2A)
Y
R4 680
CR12 CR13
(TB7-2A) K10 (TB7-2A)
Z
R5 680
CR14 CR15
TB1 DETAIL
TB2 DETAIL
(TB3-2B)
BLK
TB2-5 OUTPUT V
V NOTES 2 & 3
RED
TB2-1 RELAY V 120VAC/250VDC
(TB3-1B)
(TB4-2B)
BRN
TB2-6 OUTPUT W
W NOTES 2 & 3
(TB4-1B)
GRN
(TB5-2B)
YEL
TB2-7 OUTPUT X
X NOTES 2 & 3
GRN
TB2-2 RELAYS W & X 120VAC/250VDC
(TB5-1B)
(TB6-2B)
GRAY
TB2-8 OUTPUT Y
Y NOTES 2 & 3
ORG
TB2-3 RELAY Y 120VAC / 250VDC
(TB6-1B)
(TB7-2B)
WHT
TB2-9 OUTPUT Z
Z NOTES 2 & 3
BLU
TB2-4 RELAY Z 120VAC / 250VDC
(TB7-1B)
63D81049A09-01
K1 THROUGH K5 DETAIL
V,W,X,Y,Z DETAIL
K1 THROUGH K5 SOCKET DETAIL
TB3 THROUGH TB7 DETAIL (NOTE 2)
K5 DETAIL NOTE 4

NOTES:

1. USED ONLY ON CLN6109A AND CLN6110A AUXILIARY FUNCTION RELAY KITS.
2. WHEN ANY OF THE RELAY KITS ARE OMITTED, THE REMAINING WIRES ARE CONNECTED TO "DUMMY" TERMINAL BOARDS TB3 THROUGH TB7 (TERMINALS SHOWN IN PARENTHESES).
3. THESE CONTACTS ARE NORMALLY CLOSED WHEN USED WITH THE CLN6104A AND CLN6110A AUXILIARY FUNCTION RELAY KITS. THESE CONTACTS WITH THEIR RESPECTIVE RELAYS COMPRISE THE CLN6103A AND THE CLN6109A AUXILIARY FUNCTION RELAY KITS.
4. THIS CONTACT ADDED TO K5 ONLY WITH CLN6175A AND CLN6176A ALARM/RESET RELAY KITS AND K4 IS OMITTED.

MODEL TABLE

MODEL	SUFFIX	DESCRIPTION	
CLN6103A		N.O. / AC	AUXILIARY FUNCTION RELAY KITS
CLN6104A		N.C. / AC	
CLN6109A		N.O. / DC	
CLN6110A		N.C. / DC	
CLN6168A		AUXILIARY FUNCTION PANEL	
CLN6175A		ALARM & RESET RELAY KIT (DC)	
CLN6176A		ALARM & RESET RELAY KIT (AC)	

PREVIOUS REVISIONS AND PARTS LIST SHOWN ON BACK OF THIS DIAGRAM

CLN6168A Auxiliary Function Relay Panel
(With Auxiliary Function Relay Kits)
Schematic Diagram
Motorola No. 63D81049A09-O1
8/28/68-RS

NCE OL	MOTOROLA PART NO.	DESCRIPTION

Auxiliary Function Relay Panel EPD-17824-O

5	48C82392B03	SEMICONDUCTOR DEVICE, diode: (SEE NOTE) silicon
7	31A50378	TERMINAL BOARD: 2 dual screw terminals
5	9A83376B01	SOCKET, relay: female; 16 contact

A Alarm & Reset Kit (DC)
A Alarm & Reset Kit (AC) EPD-17825-O

14,	48C82466H17	SEMICONDUCTOR DEVICE, diode: (SEE NOTE) silicon (dc model)
	80D83379B04	RELAY, armature: telephone type; 2 stack; left stack, 2 form "A"; right stack 1 form "B"; coil res. 350 ohms ±10%; does not incl 15A83377B01 COVER
	80C83261B03	120 v ac; 60 cps; 1 form "A"; coil res. 200 ohms ±10%; (ac model)
	or80C83261B01	230 v dc; 1 form "A"; coil res. 12000 ohms ±10% (dc model)
	6S5651	RESISTOR, fixed: 680 ±5%; 1/2 w (dc model)

acement diodes must be ordered by Motorola part
ber only for optimum performance.

POWER SUPPLY DIAGRAMS

REVISIONS

DIAG. ISSUE	CHASSIS AND SUFFIX NO.	REF. SYMBOL	CHANGE	LOCATION
01		TB1	REVERSED DETAIL	SCHEMATIC

PARTS LIST

CLN6103A Auxiliary Function Relay Kit (N.O./AC)
CLN6104A Auxiliary Function Relay Kit (N.C./AC) EPD-11751-A

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
		RELAY, armature:
K1	80D83379B01	telephone type; 1 form "A"
K2	80C83261B03	power; 1 form "A"; coil res 200 ohms; contact rating 1 hp @ 115 v a-c (N.O.) NOTE: For replacement contacts, order part number 39P83979B03 (includes one set of contacts for one pole). Specify quantity. For replacement coil, order part number 24P83979B06.
	or80C83261B04	power; 1 form "B"; coil res 200 ohms; contact rating 1 hp @ 115 v a-c (N.C.) NOTE: For replacement contacts, order part number 39P83979B03 (includes one set of contacts for one pole). Specify quantity. For replacement coil, order part number 24P83979B06.

CLN6109A Auxiliary Function Relay Kit (N.O./DC)
CLN6110A Auxiliary Function Relay Kit (N.C./DC) EPD-11753-A

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
		SEMICONDUCTOR DEVICE, diode: (SEE NOTE)
CR6 thru 15	48C82466H17	silicon
		RELAY, armature:
K1	80D83379B01	telephone type; 1 form "A"
K2	80C83261B01	power; 1 form "A"; coil res 12K ohms; contact rating 1/3 hp @ 230 v d-c NOTE: For replacement contacts, order part number 39P83979B03 (includes one set of contacts for one pole). Specify quantity. For replacement coil, order part number 24P83979B05.
	or80C83261B02	power; 1 form "B"; coil res 12K ohms; contact rating 1/3 hp @ 230 v d-c NOTE: For replacement contacts, order part number 39P83979B03 (includes one set of contacts for one pole). Specify quantity. For replacement coil, order part number 24P83979B05.
		RESISTOR, fixed:
R1, 2	6S5651	680 ±5%; 1/2 w
	NON-REFERENCED ITEMS	
	31A813331	BOARD, terminal: 6 screw term.

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION

CLN6168A Auxiliary Function Relay Panel EPD-17824-O

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
		SEMICONDUCTOR DEVICE, diode: (SEE NOTE)
CR1 thru 5	48C82392B03	silicon
		TERMINAL BOARD:
TB3 thru 7	31A50378	2 dual screw terminals
		SOCKET, relay:
XK1 thru 5	9A83376B01	female; 16 contact

CLN6175A Alarm & Reset Kit (DC)
CLN6176A Alarm & Reset Kit (AC) EPD-17825-O

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
		SEMICONDUCTOR DEVICE, diode: (SEE NOTE)
CR12, 13, 14, 15	48C82466H17	silicon (dc model)
		RELAY, armature:
K5	80D83379B04	telephone type; 2 stack; left stack, 2 form "A"; right stack 1 form "B"; coil res. 350 ohms ±10%; does not incl 15A83377B01 COVER
K9, 10	80C83261B03	120 v ac; 60 cps; 1 form "A"; coil res. 200 ohms ±10%; (ac model)
	or80C83261B01	230 v dc; 1 form "A"; coil res. 12000 ohms ±10% (dc model)
		RESISTOR, fixed:
R4, 5	6S5651	680 ±5%; 1/2 w (dc model)

NOTE:

Replacement diodes must be ordered by Motorola part number only for optimum performance.

POWER SUPPLY DIAGRAMS

PAGE

POWER SUPPLIES

Power Supply Schematic Diagram (120 or 220/440 V AC Outputs) 12-1
RC Filter Kit Schematic Diagram 12-3
Power Supply Schematic Diagram (250 V DC Output) 12-5

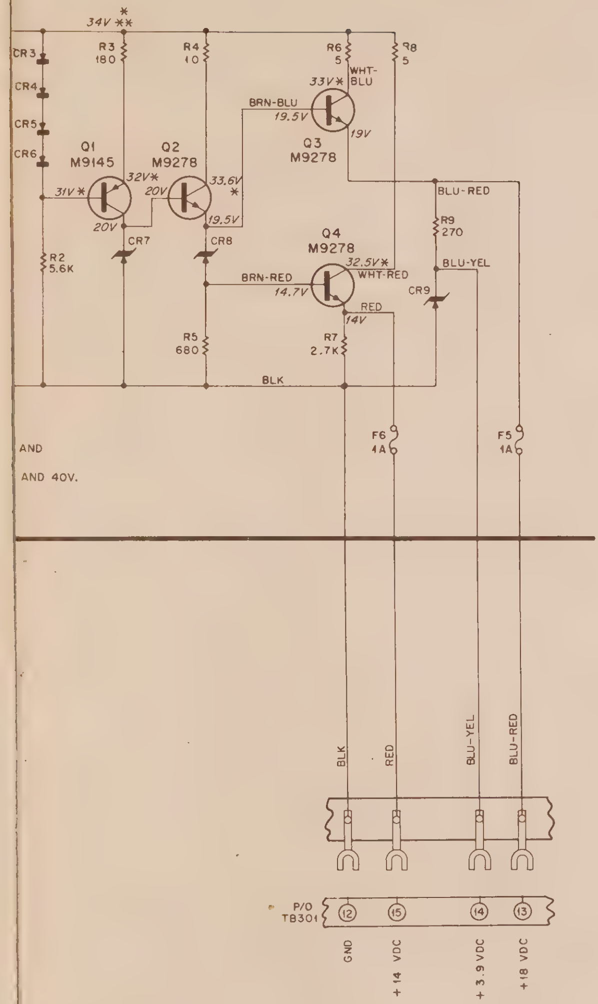

34V **
CR3
CR4
CR5
CR6
R3
180
R4
10
R6
5
R8
5
WHT-BLU
33V*
BRN-BLU
19.5V
19V
Q3
M9278
Q1
M9145
Q2
M9278
31V*
32V*
20V
20V
33.6V
*
19.5V
BLU-RED
R9
270
CR7
CR8
Q4
M9278
32.5V*
WHT-RED
BLU-YEL
R2
5.6K
BRN-RED
14.7V
CR9
RED
14V
R5
680
R7
2.7K
BLK
F6
4A
F5
4A
AND
AND 40V.
BLK
RED
BLU-YEL
BLU-RED
P/O
TB301
12
15
14
13
GND
+14 VDC
+3.9 VDC
+18 VDC

DIAGRAM NO. 63E81033A68-C1

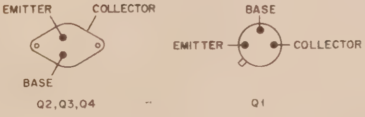
MODEL TABLE

MODEL	SUFFIX	DESCRIPTION
CHN6010A	1	CABINET KIT
CLN6129A	2	PWR. SUPPLY & REG.
CLN6130A	1	TRANSFORMER KIT

NOTES:

1. UNLESS OTHERWISE SPECIFIED
   CAPACITOR VALUES ARE IN MICROFARADS.
   RESISTOR VALUES ARE IN OHMS. K = 1000.
2. TERMINAL BOARD TB301 IS SHOWN HERE FOR REFERENCE ONLY.
3. WHERE AN "EXTERNAL INTERFACE CONTROL SWITCH" IS USED, POWER TO THE RELAYS IS SUPPLIED FROM TERMINALS 3 & 4.

TRANSISTOR DETAILS
(BOTTOM VIEW)


EMITTER
COLLECTOR
BASE
Q2,Q3,Q4
BASE
EMITTER
COLLECTOR
Q1

IF CRAIN RUNES ON 120AC
INTERMIDIT RELAYS ARE 120AC

SAME FOR 250VDC

C1161A (120 V AC) and C1162A (240/440 V AC)
Power Supplies Schematic Diagram
Motorola No. 63E81033A68-C1
8/28/68-RS

PAGE

POWER SUPPLIES

Power Supply Schematic Diagram (120 or 220/440 V AC Outputs) 12-1
RC Filter Kit Schematic Diagram 12-3
Power Supply Schematic Diagram (250 V DC Output) 12-5

PARTS LIST

CLN6129A Regulator Kit EPD-11728-C

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
		CAPACITOR, fixed: uf
C1	8K863550	4 ±10%; 200 v
C2	8K861259	.015 ±10%; 400 v
C3	23C04898B01	4000 +100-10%; 50 v
		SEMICONDUCTOR DEVICE, diode: SEE NOTE
CR1	48C83665B01	selenium; surge suppressor
CR2	48C83686B01	consists of 4 sect.
CR2A		silicon
CR2B		silicon
CR2C		silicon
CR2D		silicon
CR3, 4, 5, 6	48C82392B03	silicon
CR7	48C82533D11	silicon; zener type
CR8	48D82256C51	silicon; zener type
CR9	48C82137H05	silicon; zener type
		LAMP, glow:
DS1	65K898420	min. bay. base type; 105-120 v; 1/25 w
		FUSE, cartridge:
F1, 3	65K817956	5 amp; 125 v; slow blow type
F2	65S804910	1 amp; 125 v; slow blow type
F4	65S817955	3 amp; 125 v; slow blow type
F5, 6	65S52281	1 amp; 250 v; fast blow type
		COIL, AF:
L1	25C82599E01	choke; 20 mh
		TRANSISTOR: SEE NOTE
Q1	48R869145	P-N-P; type M9145
Q2, 3, 4	48R869278	N-P-N; type M9278; does not incl. 14K865875 INSULATOR
		RESISTOR, fixed: ±5%; 1/2 w; unl stated
R1	6S6407	220K ±10%
R2	6S3940	5.6K
R3	6S5672	180
R4	6S129512	10; 1 w
R5		680 ±10%; 1 w
R6, 8	17K852448	5; 10 w
R7	6S5652	2.7K
R9	6R476116	270 ±10%; 2 w
R10, 11	17C82291B05	180 ±10%; 5 w
		TRANSFORMER, power:
T2	25D83664B01	pri: BLK, BLK; res. 3 ohms sec: RED, YEL; total res. 0.52 ohms; with RED-BLK, BLK-WHT, GRN, GRN-YEL taps
		TERMINAL BOARD:
TB1	31C83118C01	(fanning strip); 16 slotted tongue lug terminals
		LAMPHOLDER, glow:
XDS1	60A82096A01	single cont.; bay base type
		FUSEHOLDER:
XF1 thru 6	9C82083C01	extractor post type
		SOCKET, transistor: female
XQ2	9D82673A01	2 cont.
XQ3, 4	9C82377H01	2 cont.

CLN6130A Transformer Kit EPD-11730-B

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
		TRANSFORMER:
T1	25D83274E01	pri: #1, BLK, BLK-WHT; res. 1.7 ohms pri: #2, BLK-YEL, BLK-RED; res. 1.9 ohms sec: BRN, BRN res. 0.4 ohms

CHN6010A Cabinet Kit EPD-11729-O

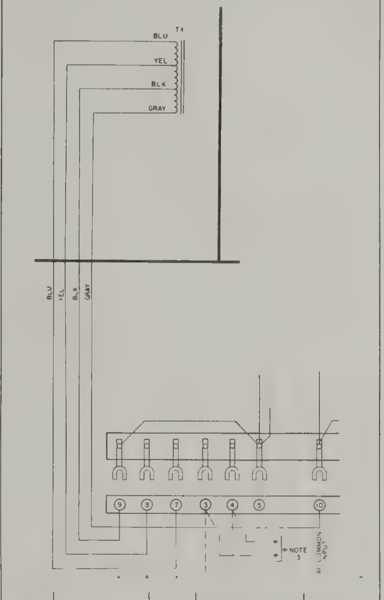
REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
		BOARD, terminal:
TB301	31B51777	16 dual screw term.
TB302	31K57123	8 dual screw term.

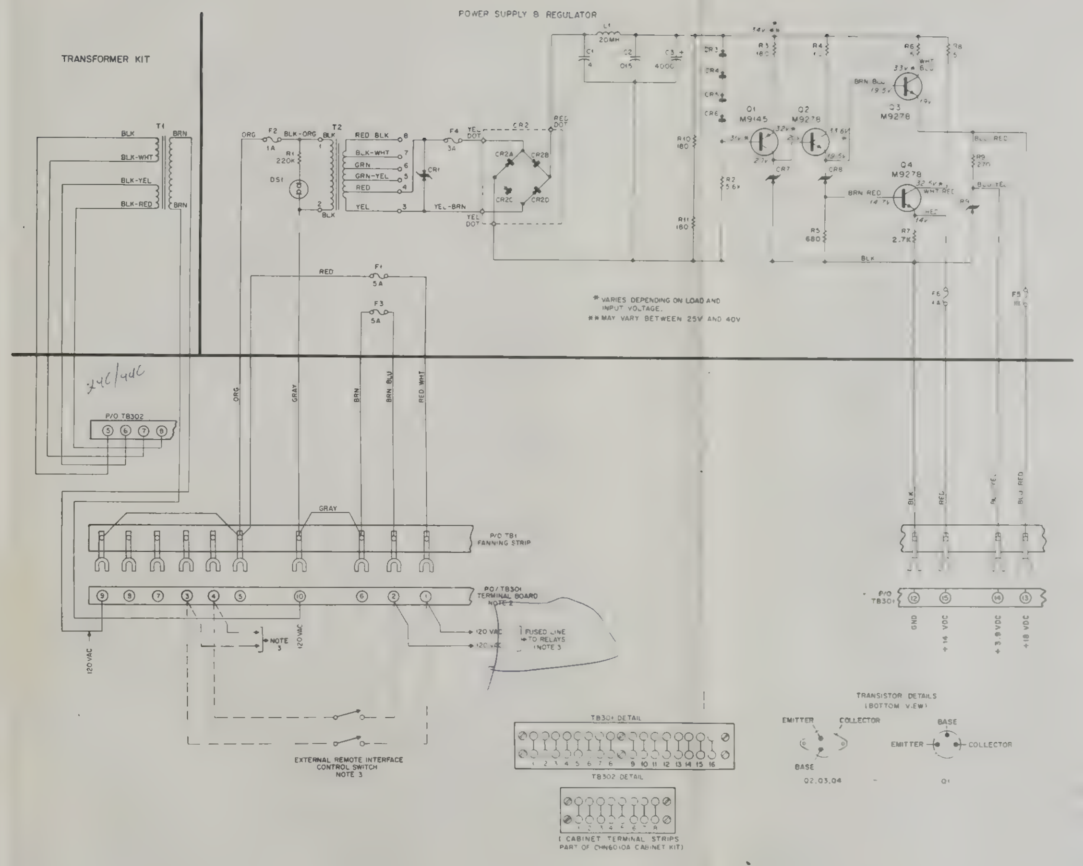
NOTE:

Replacement transistors and diodes must be ordered by Motorola part number only for optimum performance.

REVISIONS

DIAG ISSUE	CHASSIS AND SUFFIX NO.	REF. SYMBOL	CHANGE	LOCATION
B	CLN6129A-2	CR8	WAS 48D82533C08	PARTS LIST
C	CLN6130A-1	T1	WAS 25D83779B01 CIRCUIT WAS AS SHOWN BELOW	T1
C1		Q1	INTERCHANGED EMITTER AND COLLECTOR VOLTAGES	DIAGRAM


T1
BLU
YEL
BLK
GRAY
NOTE 3


POWER SUPPLY & REGULATOR
TRANSFORMER KIT
240/440
P/O TB302
P/O TB1 FANNING STRIP
P/O TB301 TERMINAL BOARD NOTE 2
EXTERNAL REMOTE INTERFACE CONTROL SWITCH NOTE 3
TB301 DETAIL
TB302 DETAIL
CABINET TERMINAL STRIPS PART OF CHN6010A CABINET KIT
TRANSISTOR DETAILS (BOTTOM VIEW)
EMITTER
COLLECTOR
BASE
Q1
+18 VDC
120 VAC

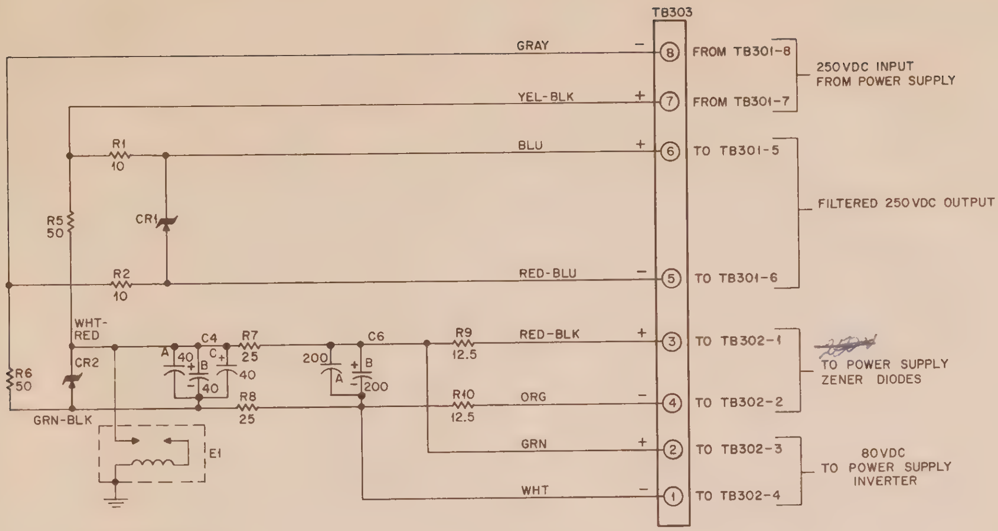
MODEL TABLE

MODEL	SUFFIX	DESCRIPTION
[illegible]	1	CABINET KIT
[illegible]	2	PWR SUPPLY & REG
[illegible]	1	TRANSFORMER KIT

NOTES
1. UNLESS OTHERWISE SPECIFIED
   CAPACITOR VALUES ARE IN MICROFARADS
   RESISTOR VALUES ARE IN OHMS [illegible]
2. TERMINAL BOARD TB301 IS SHOWN HERE FOR REFERENCE ONLY
3. WHERE AN "EXTERNAL INTERFACE CONTROL SWITCH" IS USED POWER TO THE RELAYS S SUPPLIED FROM TERMINALS 3 & 4

[illegible] RUNS ON 120AC
[illegible]
SAME FOR 250VDC

C1161A (120 V AC) and C1162A (240/440 V AC)
Power Supplies Schematic Diagram
Motorola No. 63E81033A68-C1
8/28/68-RS


TB303
GRAY
−
8
FROM TB301-8
250VDC INPUT FROM POWER SUPPLY
YEL-BLK
+
7
FROM TB301-7
R1
10
BLU
+
6
TO TB301-5
FILTERED 250VDC OUTPUT
R5
50
CR1
R2
10
RED-BLU
−
5
TO TB301-6
WHT-RED
C4
R7
25
C6
R9
12.5
RED-BLK
+
3
TO TB302-1
TO POWER SUPPLY ZENER DIODES
A
40
B
C
40
40
200
A
B
200
CR2
R6
50
GRN-BLK
R8
25
R10
12.5
ORG
−
4
TO TB302-2
E1
GRN
+
2
TO TB302-3
80VDC TO POWER SUPPLY INVERTER
WHT
−
1
TO TB302-4

TB303 DETAIL

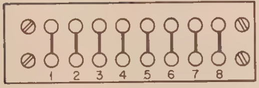


DIAGRAM NO. 63C81033A69-B1

NOTE:
UNLESS OTHERWISE SPECIFIED:
ALL RESISTOR VALUES ARE IN OHMS; K=1000
ALL CAPACITOR VALUES ARE IN MICROFARADS

MODEL TABLE

MODEL	SUFFIX	DESCRIPTION
CLN6127A	2	POWER RESISTOR KIT
CHN6011A		CABINET KIT

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION

PARTS LIST

CLN6127A Power Resistor Kit EPD-12088-B

		CAPACITOR, fixed: uf unl. stated
C4	23K821734	c/o 3 sec.
C4A		◠40 +50-10%; 450 v
C4B		□40 +50-10%; 450 v
C4C		△40 +50-10%; 450 v
C6	23D82125B18	c/o 2 sect.
C6A		△200; 250 v
C6B		◠200; 250 v
		RECTIFIER, selenium:
CR1	48C83665B03	surge suppressor
CR2	48C83665B02	surge suppressor
		SURGE ARRESTOR
E1	80C83783B02	spark gap
		RESISTOR, fixed: ±5%; 50 w
R1, 2	17C83835B03	10
R5, 6	17C83835B01	50; 200 w
R7, 8	17C83835B02	25; 100 w
R9, 10	17K858372	12.5
		BOARD, terminal:
TB303	31K51723	8 dual screw term.

CHN6011A Cabinet Kit (AC) EPD-12089-O

NON-REFERENCED ITEMS		
	15E83824B01	HOUSING
	15D83825B01	DOOR HOUSING
	15D83826B01	COVER, rain
	55B83616B01	LOCK, incl. 55K893872 key; 2 req'd.
	32B83658B01	GASKET
	32B83658B02	GASKET

REVISIONS

DIAG. ISSUE	CHASSIS AND SUFFIX NO.	REF. SYMBOL	CHANGE	LOCATION
A	CLN6127A-1	E1	ADDED	CR2
A1	CLN6127A-1		REVISED DESCRIPTION	MODEL TABLE
B	CLN6127A-2	C1, 2, 3, 5	REMOVED	DIAGRAM
B1		C6	WAS 23K821734 (40 uf)	

C1163A RC Filter
Schematic Diagram
Motorola No. 63C81033A69-B1
8/28/68-RS

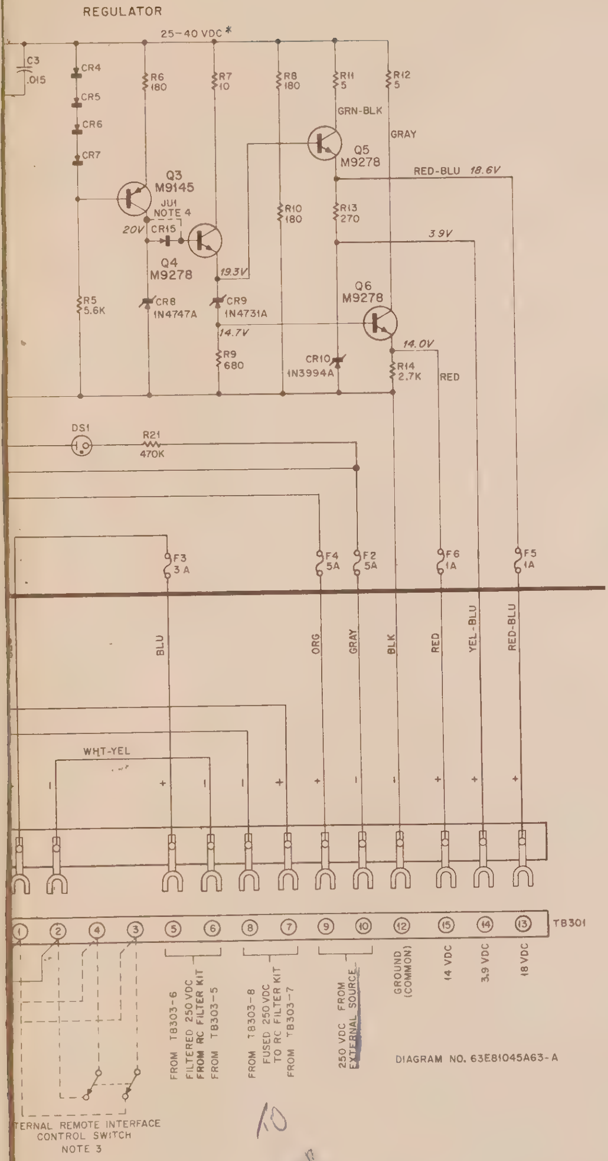
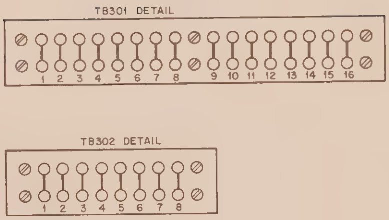

REGULATOR
25-40 VDC*
C3
.015
CR4
CR5
CR6
CR7
R6
180
R7
10
R8
180
R11
5
R12
5
GRN-BLK
GRAY
Q5
M9278
RED-BLU 18.6V
Q3
M9145
JU1
NOTE 4
20V
CR15
Q4
M9278
19.3V
R10
180
R13
270
3.9V
Q6
M9278
R5
5.6K
CR8
1N4747A
CR9
1N4731A
14.7V
R9
680
CR10
1N3994A
14.0V
R14
2.7K
RED
DS1
R21
470K
F3
3 A
F4
5A
F2
5A
F6
1A
F5
1A
BLU
ORG
GRAY
BLK
RED
YEL-BLU
RED-BLU
WHT-YEL
TB301
FROM TB303-6
FILTERED 250 VDC
FROM RC FILTER KIT
FROM TB303-5
FROM TB303-8
FUSED 250 VDC
TO RC FILTER KIT
FROM TB303-7
250 VDC FROM
EXTERNAL SOURCE
GROUND
(COMMON)
14 VDC
3.9 VDC
18 VDC
TERNAL REMOTE INTERFACE
CONTROL SWITCH
NOTE 3

DIAGRAM NO. 63E81045A63-A

TO
FILTER

(CABINET TERMINAL STRIPS)


TB301 DETAIL
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16
TB302 DETAIL
1 2 3 4 5 6 7 8

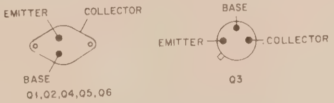
MODEL TABLE

MODEL	SUFFIX	DESCRIPTION
CLN6159A	1	REGULATOR AND INVERTER KIT
CHN6014A		CABINET KIT

NOTES
1. UNLESS OTHERWISE SPECIFIED:
   ALL CAPACITOR VALUES ARE IN MICROFARADS.
   ALL RESISTOR VALUES ARE IN OHMS; K=1000.
2. TERMINAL BOARDS TB301 & TB302 ARE SHOWN HERE FOR REFERENCE ONLY.
3. WHERE AN "EXTERNAL REMOTE INTERFACE CONTROL SWITCH" IS USED, POWER TO THE RELAYS IS SUPPLIED FROM TERMINALS 3 & 4.
4. JU1 FACTORY INSTALLED AS REQUIRED

* VARIES DEPENDING ON LOAD AND INPUT VOLTAGE.

TRANSISTOR DETAILS
(BOTTOM VIEW)


EMITTER
COLLECTOR
BASE
Q1,Q2,Q4,Q5,Q6
BASE
EMITTER
COLLECTOR
Q3

C1160B Power Supply Schematic Diagram
Motorola No. 63E81045A63-A
8/28/68-RS

PARTS LIST

CLN6159A Power Supply EPD-15730-A

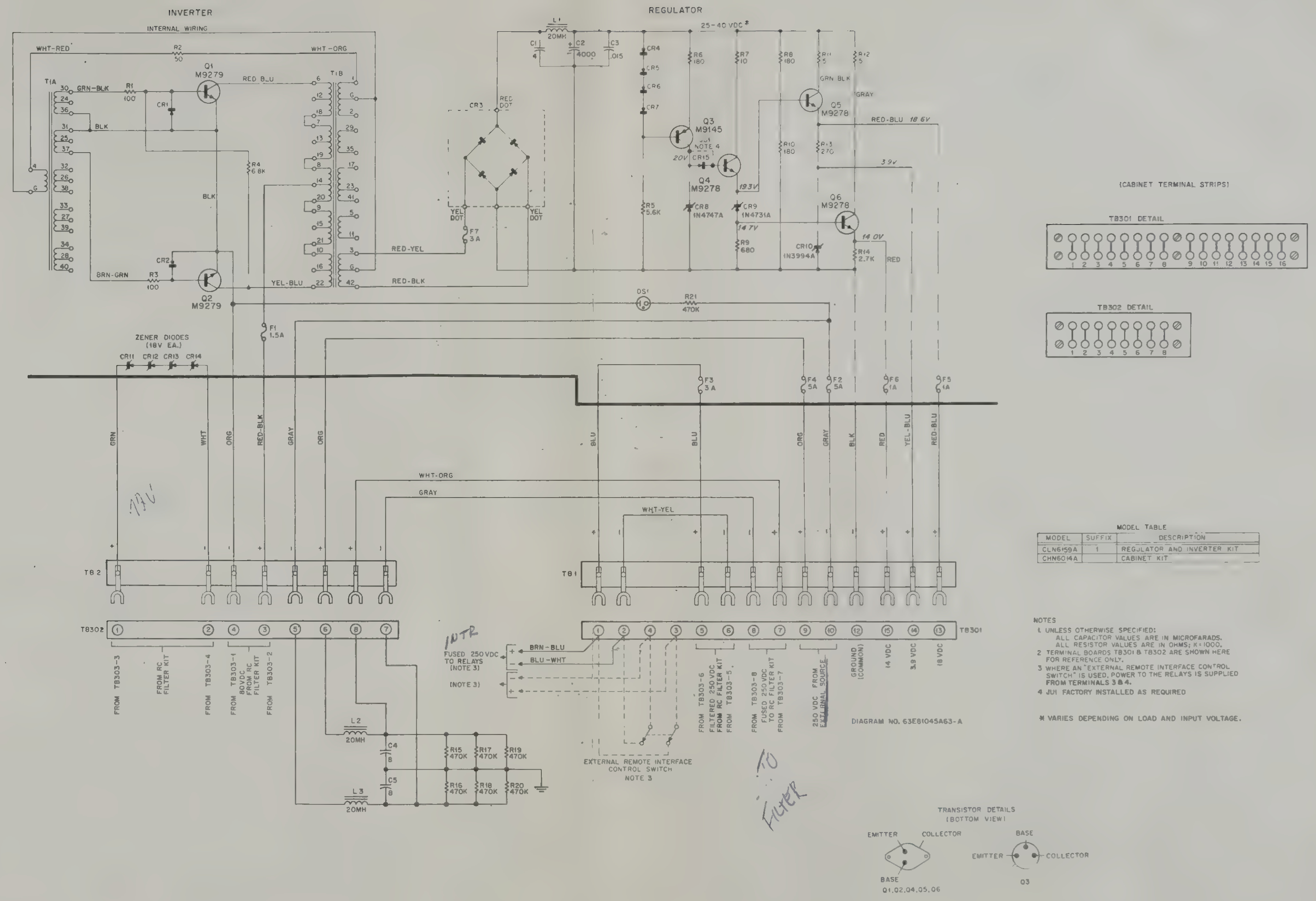
REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
		CAPACITOR, fixed: uf; unl stated
C1	8K863550	4 ±10%; 200 v
C2	23C04898B01	4000 +100-10%; 50 v
C3	8K861259	.015 ±10%; 400 v
		SEMICONDUCTOR DEVICE, diode: (SEE NOTE)
CR1, 2	48C82392B03	silicon
CR3	48C83686B01	consists of 4 sect; silicon
CR4, 5, 6, 7, 15	48C82392B03	silicon
CR8	48D82256C39	zener; 20 v
CR9	48D83461E13	zener 4.3 v
CR10	48C82137H05	silicon; zener; 4.3 v
CR11, 12, 13, 14	48C82321E03	silicon; zener; 18 v
		LAMP, glow:
DS1	65K898920	type 105 120 v; 1/25 w
		FUSE, cartridge:
F1	65S890033	1.5 amp; 250 v
F2, 4	65K817956	5 amp; 125 v
F3, 7	65K817955	3 amp; 125 v
F5, 6	65S52281	1 amp; 250 v
		COIL, AF:
L1	25C82599E01	choke; 20 mh
		TRANSISTOR (SEE NOTE)
Q1, 2	48R869279	N-P-N; type M9279
Q3	48R869145	P-N-P; type M9145
Q4, 5, 6	48R869278	N-P-N; type M9278
		RESISTOR, fixed: ±5%; 1/2 w unl stated
R1, 3	6S6415	100 ±10%; 1 w
R2	17K81760	50 ±10%; 10 w
R4	6S5690	6.8K ±10%; 2 w
R5	6S3940	5.6K
R6	6S5672	180
R7	6S129512	10; 1 w
R8, 10	17C82291B05	180 ±10%; 5 w
R9	6R5594	680 ±10%; 1 w
R11, 12	17K852448	5; 10 w
R13	6R476116	270 ±10%; 2 w
R14	6S5652	2.7K
R21	6S6377	470K ±10%
		TRANSFORMER:
T1	25D82774E01	consists of:
T1A		feedback
T1B		power
		TERMINAL BOARD:
TB1	31C83118C01	(fanning strip); 16 slotted tongue lug terminals
TB2	31C83118C02	(fanning strip); 8 slotted tongue lug terminals
		LAMPHOLDER:
XDS1	60B83003E01	single cont; bay base
		FUSEHOLDER:
XF1 thru XF7	9C82083C01	extractor post type
		SOCKET, diode:
XCR11, 12, 13, 14	9C82377H01	2 cont.
		SOCKET, transistor:
XQ1, 2, 5, 6	9C82377H01	2 cont.
XQ4	9D82673A01	2 cont.
NON-REFERENCED ITEMS		
	55B83616B01	LOCK, incl. mtg. hardware & 55K893872 KEY; 2 req'd.
	7D82926G03	HEAT SINK

CHN6014A Cabinet Kit EPD-15731-O

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
		CAPACITOR, fixed: uf ±10%; 600 v
C4, 5	8C82560E01	8
		COIL, AF:
L2, 3	25C82599E01	choke; 20 mh
		RESISTOR, fixed: ±10%; 2 w
R15, 16, 17, 18, 19, 20	6S2080	470
		TERMINAL BOARD:
TB301	31B51777	16 dual screw term.
TB302	31K57123	8 dual screw term.

NOTE:

Replacement transistors and diodes must be ordered by Motorola part number only for optimum performance.


INVERTER
INTERNAL WIRING
WHT-RED
R2 50
WHT-ORG
Q1 M9279
RED BLU
T1A
T1B
30 GRN-BLK
R1 100
CR1
BLK
R4 6.8K
CR2
BRN-GRN
R3 100
Q2 M9279
YEL-BLU
RED-YEL
RED-BLK
F1 1.5A
ZENER DIODES (18V EA.)
CR11 CR12 CR13 CR14
REGULATOR
L1 20MH
C1 4
C2 4000
C3 .015
25-40 VDC *
CR3
RED DOT
YEL DOT
F7 3A
CR4 CR5 CR6 CR7
R5 5.6K
R6 180
R7 10
R8 180
R11 5
R12 5
Q3 M9145
JU1 NOTE 4
20V
CR15
Q4 M9278
19.3V
CR8 1N4747A
CR9 1N4731A
14.7V
R9 680
R10 180
CR10 1N3994A
GRN BLK
GRAY
Q5 M9278
RED-BLU 18.6V
R13 270
3.9V
Q6 M9278
14.0V
R14 2.7K
RED
DS1
R21 470K
F3 3A
F4 5A
F2 5A
F6 1A
F5 1A
GRN
WHT
ORG
RED-BLK
GRAY
ORG
BLU
BLU
ORG
GRAY
BLK
RED
YEL-BLU
RED-BLU
WHT-ORG
GRAY
WHT-YEL
13V
TB2
TB1
TB302
TB301
FROM TB303-3
FROM RC FILTER KIT
FROM TB303-4
FROM TB303-1
80VDC FROM RC FILTER KIT
FROM TB303-2
L2 20MH
L3 20MH
C4 8
C5 8
R15 470K
R16 470K
R17 470K
R18 470K
R19 470K
R20 470K
INTR
FUSED 250VDC TO RELAYS (NOTE 3)
BRN-BLU
BLU-WHT
(NOTE 3)
EXTERNAL REMOTE INTERFACE CONTROL SWITCH NOTE 3
FROM TB303-6
FILTERED 250VDC FROM RC FILTER KIT
FROM TB303-5
FROM TB303-8
FUSED 250VDC TO RC FILTER KIT
FROM TB303-7
250 VDC FROM EXTERNAL SOURCE
GROUND (COMMON)
14 VDC
3.9 VDC
18 VDC
TO FILTER
DIAGRAM NO. 63E81045A63-A
(CABINET TERMINAL STRIPS)
TB301 DETAIL
TB302 DETAIL
TRANSISTOR DETAILS (BOTTOM VIEW)
EMITTER
COLLECTOR
BASE
Q1,Q2,Q4,Q5,Q6
Q3

MODEL TABLE

MODEL	SUFFIX	DESCRIPTION
CLN6159A	1	REGULATOR AND INVERTER KIT
CHN6014A		CABINET KIT

NOTES

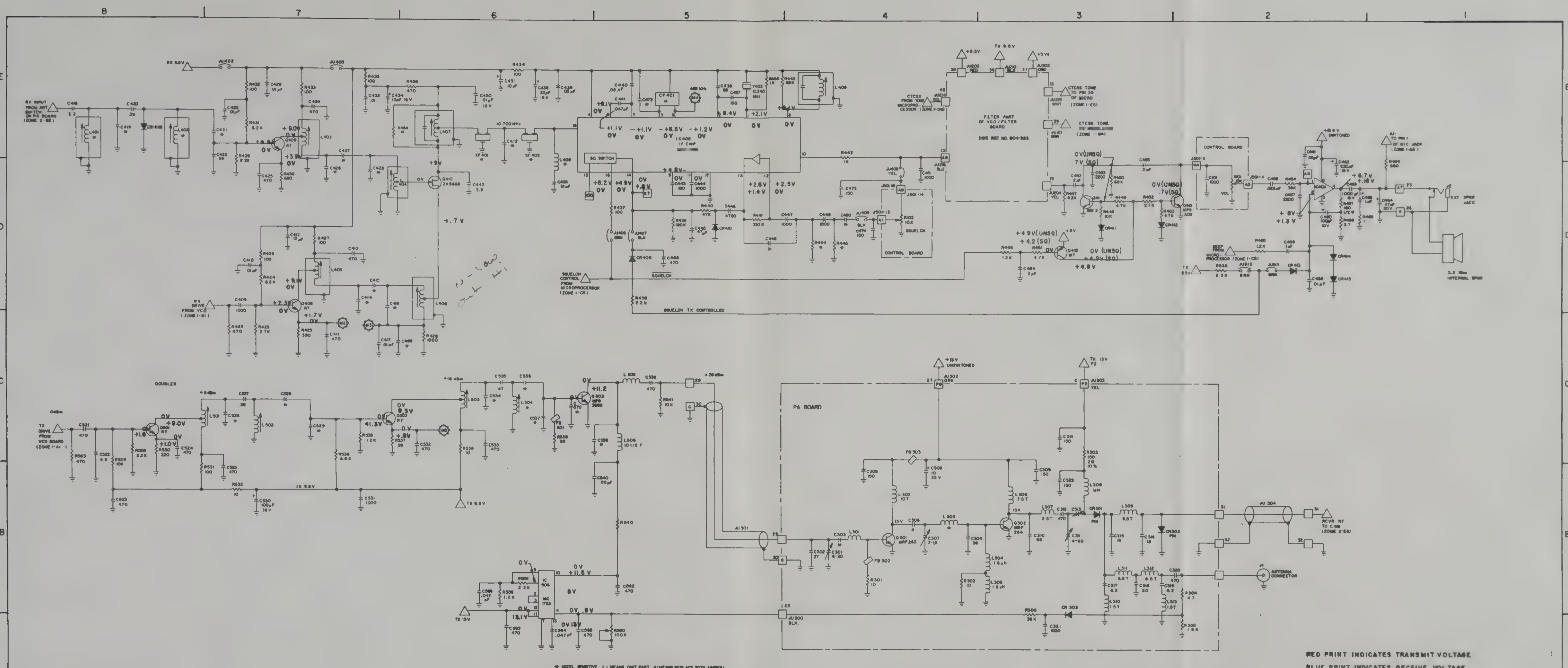
1. UNLESS OTHERWISE SPECIFIED:
   ALL CAPACITOR VALUES ARE IN MICROFARADS.
   ALL RESISTOR VALUES ARE IN OHMS; K=1000.
2. TERMINAL BOARDS TB301 & TB302 ARE SHOWN HERE FOR REFERENCE ONLY.
3. WHERE AN "EXTERNAL REMOTE INTERFACE CONTROL SWITCH" IS USED, POWER TO THE RELAYS IS SUPPLIED FROM TERMINALS 3 & 4.
4. JU1 FACTORY INSTALLED AS REQUIRED

* VARIES DEPENDING ON LOAD AND INPUT VOLTAGE.

REVISIONS

DIAG. ISSUE	BOARD AND SUFFIX NO.	REF. SYMBOL	CHANGE	LOCATION
O1			NOTE 3 WAS NOTE 2	CONTROL SWITCH
A	CLN6159A-1	CR8 CR9	WAS 48C82533D11 WAS 48D82256C51	PARTS LIST
		CR15	ADDED	Q3 BASE

C1160B Power Supply Schematic Diagram
Motorola No. 63E81045A63-A
8/28/68-RS


RX 9.5V
RX INPUT FROM ANT SWITCH ON PA BOARD (ZONE 2-B2)
RX DRIVE FROM VCO (ZONE 1-B1)
FILTER PART OF VCO/FILTER BOARD
CTCSS FROM TONE MICROPROCESSOR (ZONE 1-D5)
CTCSS TONE TO PIN 36 OF MICRO (ZONE 1-E5)
CONTROL BOARD
SQUELCH CONTROL FROM MICROPROCESSOR (ZONE 1-C5)
SQUELCH TX CONTROLLED
SQUELCH
SQ. SWITCH
IC408 IF CHIP
10.700 MHz
455 KHz
VOL
EXT SPKR JACK
3.2 Ohm INTERNAL SPKR
TO PIN 1 OF MIC JACK (ZONE 1-A8)
BEEP FROM MICROPROCESSOR (ZONE 1-C8)
DOUBLER
TX DRIVE FROM VCO BOARD (ZONE 1-A1)
TX 9.5V
TX 13V
+13V UNSWITCHED
PA BOARD
RCVR RF TO C416 (ZONE 2-E8)
ANTENNA CONNECTOR
IC 505 MC 7723
Q301 MRF 260
Q302 MRF 264
Q503 MRF 3866
Q410 2N5668
8
7
6
5
4
3
2
1
E
D
C
B
A

✱ MODEL SENSITIVE (- MEANS OMIT PART, JU MEANS REPLACE WITH JUMPER)

	C306	C303	C414	C415	C416	C419	C421	C426	C427	C428	C432	C472	C460	C526	C528	C529	C534	C536	C537	C570	L303	L401	L402	L504				R464	CF401	XF401 XF402	L408		C448	C450	C538	R444	R448
RH 250/256 A 132-150 MHz	18pF	180pF	8.2pF	.47pF	10pF	6.8pF	10pF	8.2pF	.39pF	8.2pF	3.9pF	—	—	4.7pF	10pF	4.7pF	10pF	8.2pF	27pF	—	3.5T(-8)	-20	-20	-20				—	302-086	302-322	39µH		82pF	1000pF	6.8pF	13K	13K
RH 250/256 B 150-162 MHz	18pF	82pF	6.8pF	.47pF	8.2pF	6.8pF	8.2pF	6.8pF	39pF	6.8pF	3.9pF	—	—	3.3pF	6.8pF	3.9pF	6.8pF	6.8pF	22pF	—	3.5T(-8)	-20	-20	-20				—	302-086	302-322	39µH		82pF	1000pF	3.9pF	13K	13K
RH 250/256 C 162-175 MHz	22pF	56pF	5.6pF	39pF	6.8pF	6.8pF	8.2pF	5.6pF	33pF	5.6pF	3.9pF	—	1000pF	2.7pF	5.6pF	3.9pF	5.6pF	6.8pF	6.8pF	22pF	2.5T(-1)	-2	-2	-2				—	302-086	302-322	39µH		82pF	1000pF	3.9pF	13K	13K
RH 250/256UK 162-175 MHz	22pF	56pF	5.6pF	39pF	6.8pF	6.8pF	8.2pF	5.6pF	.33pF	5.6pF	15pF	1000pF	1000pF	2.7pF	5.6pF	3.9pF	5.6pF	6.8pF	6.8pF	22pF	2.5T(-1)	-2	-2	-2				22K	302-442	302-444	REPLACE WITH 3.01 MEG R408		68pF	JU	3.9pF	15K	—

RED PRINT INDICATES TRANSMIT VOLTAGE
BLUE PRINT INDICATES RECEIVE VOLTAGE

SCHEMATIC 704-155H
Sheet 2